

Our Actions, Our Estuary
9th Biennial State of the San Francisco Estuary Conference
POSTER ABSTRACTS

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Using seabird long term data for monitoring the state of the SF Bay Estuary

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We present long-term data sets on two seabird species, the Brandt's cormorant (*Phalacrocorax penicillatus*) and the least tern (*Sternula antillarum browni*), breeding in San Francisco Bay. The Brandt's cormorant colony on Alcatraz Island is one of the few known estuarine breeding sites for this species, and it has experienced a steady population increase since its inception in 1991 (with the exception of 2008 and 2009). Data on this estuarine colony has been compared to a coastal colony (Año Nuevo Island) and an offshore colony (Southeast Farallon Island). Breeding success has fluctuated in similar ways between these three colonies; however, mean productivity of Brandt's cormorants on Alcatraz has been higher. Alcatraz cormorants benefit from the productive waters of central San Francisco Bay, which may provide enhanced foraging opportunities that their coastal and offshore conspecifics may not encounter. Least terns were first discovered nesting on the Naval Air Station, Alameda in 1976, and this is the largest colony in the state north of San Luis Obispo county. This piscivorous species forages primarily on small, pelagic, schooling fish species in the Bay; prey dropped at this breeding site have been collected and identified in most years since 1981, and sizes of dropped prey have been collected since 2000. While silversides (family *Atherinopsidae*) were the dominant prey in most years, other families (e.g., *Engraulidae* (anchovy), *Clupeidae* (herring), and *Embiotocidae* (surfperches)) have varied greatly in their relative importance in dropped prey collections. Sizes of dropped prey have varied from year to year, with the largest dropped prey found in 2006. Results on these two species have indicated changing conditions in the estuary.

Key Words - *SF Bay; Brandt's Cormorant; Least Tern*

Theme: Biological Species

Poster Board Number: 33. **Submission Number:** 247

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The presence and relative abundance of delta smelt in the Sacramento Deep Water Shipping Channel.

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The California Department of Fish and Game (CDFG) conducted several supplemental surveys in the Sacramento Deep Water Shipping Channel (SDWC) to gain presence and relative abundance information regarding delta smelt. These surveys employed several CDFG Long Term Monitoring gear types to target different life stages from late spring to early fall. The SDWC runs roughly 23 nautical miles (~26.5 statute miles) from its mouth at Cache Slough to the turning basin in West Sacramento. This sampling can be used to help in the understanding of seasonal SDWC usage by delta smelt. Early survey results showed that higher densities of juvenile delta smelt were associated with higher salinities and turbidities.

Key Words - *delta smelt*

Theme: Biological Species

Poster Board Number: 20. Submission Number: 126

POSTER ABSTRACTS

Re-Oaking the Valleys: Reintroducing Native Trees Back into the Bay Area's Suburban Landscapes

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A century ago, many of California's now-suburban landscapes were oak savannas, dominated by stately valley oaks. Early towns were designed to take advantage of the trees' natural beauty and the practical benefits of shading during the hot summer. Most of the savannas were cleared before 1900 to make way for orchards; their former distribution has been largely forgotten. Our research shows that the dispersed natural spacing of these trees is consistent with the structure of contemporary suburban landscapes, and that strategic reintroduction could provide valuable functions for people and the ecosystem. This simple idea would elegantly retrofit suburbs into the California landscapes they inhabit, transforming neighborhoods that often lack effective tree cover, ecological amenities, and sense of place. Strategically incorporating native trees in the many underutilized spaces (medians, parking lots, commercial lawns) will create an aerial canopy that reduces the urban heat island effect (and associated health and energy impacts) while storing carbon and reducing runoff. Designed within a regional context to link neighboring populations of oaks and oak-associated birds, Re-Oaking will also help reestablish native species. Creating viable densities of valley oaks -- whose distance of genetic exchange is relatively small -- may help this much revered but declining endemic California tree persist in the face of climate change.

Key Words - *valley oak; urban forestry; climate change*

Theme: Biological Species

Poster Board Number: 38. **Submission Number:** 263

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Marsh Vegetation Patterns in South San Francisco Bay: 1989-2008

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Large-scale plant community changes in the remaining marshes of South San Francisco Bay were first observed in the 1970s. In 1989 the City of San Jose commissioned a detailed study of the marshes potentially affected by the freshwater discharge from the Water Pollution Control Plant (WPCP). Subsequent mapping studies were conducted in 1991, 1994, and annually thereafter. This long-term vegetation monitoring effort tracked changes in the extent and composition of the marshes in South San Francisco Bay. The total marsh area mapped in 2008 was 1818 acres for the Main Study Area and 281 acres for the Reference Area. Marsh habitat within the Main Study Area increased by 396.1 acres between 1989 and 2008. During the same period, 90.2 acres of new marsh formed in the Reference Area. Between 1989 and 2006, there had been a net conversion from salt to brackish marsh. However, in 2007 and 2008, a large-scale conversion of brackish marsh to salt marsh occurred across the entire Main Study Area and Reference Area. Marsh conversion in 2007 and 2008 appears to be related to a combination of factors. The large-scale vegetation shifts and conversions between marsh types between 2006 and 2008 (when WPCP discharges have remained relatively constant), indicate that interannual variations in rainfall, surface water salinities, temperature, mean sea level, and changes in tidal prism (as evidenced by the large amount of marsh gain in the same period) play a large role in species distribution.

Key Words - *South Bay Marshes; Marsh Vegetation Patterns in South San Francisco Bay; long-term mapping*

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An Experimental Approach to Evaluate Entrainment Losses of Delta Smelt in the South Delta

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Water management operations are considered a contributing factor to the decline of delta smelt and other pelagic organisms in the upper San Francisco Estuary, where the State Water Project (SWP) and the Federal Central Valley Project (CVP) operate year-round. We conducted the first experimental evaluation of the relation between delta smelt salvage at the Skinner Fish Facility (SFF) and underlying entrainment losses at the SWP in the south Delta. We examined the feasibility of using cultured delta smelt in mass mark-recapture experiments in February and March 2009 (adults) and June 2009 (juveniles) to estimate: 1) the percent of fish recaptured at SFF of the total released at the entrance of SFF (fish facility efficiency), 2) the percent of fish recaptured at SFF of the total released at the entry point of Clifton Court Forebay (CCF), a reservoir for SWP exports (percent recovery), and 3) the fish losses in CCF (pre-screen loss). All fish were calcein-marked, adults were additionally photonically-marked and strontium-marked. Fish facility efficiency estimates declined in successive releases: February (52.0%, n-released: 400), March (44.0%, n-released: 200) and June (24%, n-released: 800). The percent recovery of fish released in CCF declined greatly over time: February (2.98%, n-released: 5,707); March (0.42%, n-released: 2,849) and June (0.03%, n-released: 14,413). Correspondingly, pre-screen losses increased in successive releases: February (94.2%); March (99.0%) and June (99.9%). We concluded that: 1) delta smelt can be readily mass-marked to quantify entrainment losses; 2) entrainment losses of delta smelt could be much higher at times compared to other species previously studied at the SWP; 3) pre-screen loss was overwhelmingly the largest source of mortality for delta smelt; 4) CCF entrainment monitoring is needed to better interpret and validate critical relations between salvage statistics and the magnitude and variability of direct delta smelt losses.

Key Words - *delta smelt; pre-screen loss; State Water Project; salvage; mark-recapture; marking; monitoring; entrainment; water exports*

Theme: Biological Species

Poster Board Number: 23. **Submission Number:** 176

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Remarkable persistence of native fishes in small streams of the urbanized San Francisco Estuary, California U.S.A

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There are approximately 70 streams that flow into the San Francisco Bay (Bay), many of which are surrounded by highly urbanized landscapes. Although these systems are heavily invaded and impacted, there is little known about the effects on native fishes. From 1993-1999, Leidy et al. sampled 275 sites within 23 watersheds. Here we provide an overview of the current status of native fishes in the small streams and emphasize several environmental variables associated with native fish assemblages.

Despite the compounding impacts of habitat modification, pollution, changes to the natural flow regime, and the introduction of nonnative fauna, there persist a relatively diverse and abundant native fish population. Based on historical records, only two species are locally extinct, tidewater goby (*Eucyclogobius newberryi*) and coho salmon (*Oncorhynchus kisutch*), and only one is globally extinct, thicktail chub (*Gila crassicauda*). In total 77 fish species were observed, 33 of which are native. Of the native fishes, 13 are widely distributed with moderate-high population abundances and 5 have restricted distributions with low population abundances. Fifty-four percent of native fishes were found in headwater streams above 125 m, thus indicating a preference for relatively undisturbed conditions of middle-headwater elevations. Eighteen percent of the native fish species found are euryhaline marine, including 15 species of which are saltwater dispersants. We postulate that salinity tolerance has assisted in the persistence of native fish by allowing for migration and recolonization to neighboring streams while restricting the frequency of invasions by nonnative fishes.

Our observations suggest that urbanization is a complex phenomenon and its effects on native fishes vary greatly depending on multiple, interacting factors. To better understand the observed patterns of native fishes in Bay streams we are developing a GIS framework to elucidate the relationship between large-scale land use patterns and other environmental variables.

Key Words - *small streams, urbanization, native fishes, San Francisco Estuary, persistence, conservation*

Theme: Biological Species

Poster Board Number: 28. Submission Number: 141

POSTER ABSTRACTS

Residence of Sacramento River Winter-Run Chinook Salmon in the Sacramento-San Joaquin Delta: Outmigration Coincides with Pulse Flows and Floodplain Drainage

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The Delta provides essential habitat for Sacramento River winter-run Chinook salmon during their juvenile development. Winter-run Chinook salmon reside in the Delta as fry and/or smolts to feed and physiologically transform for ocean life. We identified patterns of juvenile migration entering and exiting the Delta by using monitoring data from the upper Sacramento River, lower Sacramento River at Knights Landing, and in the western Delta at Chipps Island. Residence time in the Delta can vary from a couple of days to several months, and generally spans from November through May, with the majority of the population exiting the Delta in March, regardless of time of entry into the Delta, residence time, or fork length. We found that flows and floodplain drainage drive peak outmigration events to Chipps Island. The onset of outmigration from the Sacramento River to Chipps Island coincides with pulse flow thresholds. Winter run outmigration to Chipps Island is positively correlated with spring flows in the Sacramento River measured at Freeport ($R^2 = 0.27$; $p < 0.01$). Peak winter-run outmigration from the Yolo Bypass floodplain is in response to drainage of the floodplain. Understanding the importance of flows to winter-run use of the Delta is crucial to informing current water management decisions seeking to balance water demands and species conservation.

Key Words - *Winter run Chinook salmon, outmigration, Sacramento River flows, Yolo Bypass, Delta*

Theme: Biological Species

Poster Board Number: 26. **Submission Number:** 241

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The Abundance and Distribution of Pinnipeds and Their Impact on the Anadromous Fish Populations and Recreational Fisheries in the Sacramento-San Joaquin Delta

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For decades, there has been competition between marine mammals and commercial fisheries worldwide. Anadromous fishes found in the Sacramento Delta are part of commercial and recreational fisheries, an important economic element for the local populations from the coastal regions to the breeding habitats far inland. Since the enactment of the federal Marine Mammal Protection Act in 1972, the populations of California sea lions (*Zalophus californianus*) and Pacific harbor seals (*Phoco vitulina*), both opportunist feeders known to prey on salmonids, have grown at rapid rates, while the anadromous fish populations which migrate inland throughout the Sacramento Delta have declined dramatically.. The population explosion of these marine mammals has resulted in increased foraging competition. As sea lions and harbor seals increase their foraging range into the river system where their natural predators are not present, their main competition for resources is humans, particularly recreational fishermen.

The current abundance and distribution of pinnipeds in the Sacramento River was examined from Rio Vista, CA to the confluence of the American River. The sampling area was divided into five strata and using a random sampling schedule, observations were made from a powerboat in the river and dockside surveys were conducted. Additionally data was collected from boaters and fishermen through web and fax surveys.

Five individual sea lions (identified through markings) were in the confines of the sampling area throughout the sampling period of September 15, 2007 to January 15, 2008. Individual sea lions were sometimes observed catching and consuming adult salmon at rates of as many as five per hour. No harbor seals were observed.

The impact of these marine mammals on anadromous fish populations could not be determined. The presence of a few voracious feeders could however severely impact fish populations, especially if egg bearing females were being consumed.

The study gives marine resource managers and other stakeholders baseline data for which to compare future pinniped abundance and distribution studies in an effort to manage the marine mammals and fish populations which are impacted.

Key Words - *pinnipeds; salmon; recreational fisheries; delta*

Theme: Biological Species

Poster Board Number: 19. Submission Number: 219

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Double-crested Cormorant declines in San Francisco Bay

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The number of breeding pairs of Double-crested Cormorant (*Phalacrocorax auritus*) in San Francisco Bay have precipitously declined in recent years. Two of the largest colonies reside on the San Francisco-Oakland Bay Bridge (SFOBB) and the Richmond-San Rafael Bridge (RSRB). Annual counts of nests on both bridges since 1988 show peak nesting occurred in 2000 on the RSRB (669 nests) and in 2007 on the SFOBB (814 nests). Since these peaks in the number of nests, counts have varied interannually but have declined recently. Results from 2009 showed sharp declines. In only two years (from 2007 to 2009), we observed reductions of 65% and 90% on the RSRB and the SFOBB, respectively, in estimated numbers of breeding pairs. Coincidentally, Brandt's Cormorants (*Phalacrocorax penicillatus*) in the Bay (Alcatraz Island) and other colonies along the coast of central California were also experiencing reduced or arrested breeding, in addition to an increase in mortality. There are many reasons being considered for the drop in breeding Double-crested Cormorant numbers, including disturbance (from the new eastern span of the SFOBB and RSRB seismic maintenance), contaminants affecting breeding success and movement to other breeding sites. However, food shortage also may be an important factor. The northern anchovy (*Engraulis mordax*), a commonly-occurring pelagic schooling forage fish with a high lipid content, occurred in anomalously low abundances in the Bay during the cormorant breeding seasons of 2008 and 2009, which coincided with the steep drop in breeding numbers. A more detailed study of this once abundant species is planned to better understand the observed declines.

Key Words - *Double-crested Cormorant; breeding pairs; San Francisco-Oakland Bay Bridge; Richmond-San Rafael Bridge; northern anchovy; disturbance; contaminants*

Theme: Biological Species

Poster Board Number: 32. **Submission Number:** 222

POSTER ABSTRACTS

Delta Smelt Sperm Storage and Use of Buffered Saline Solution to Extend Sample Life

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Abstract: Delta Smelt, *Hypomesus transpacificus*, are an endangered species endemic to the Sacramento Delta region in Northern California and therefore a strong candidate for short (refrigeration) and longterm (cryopreservation) preservation of sperm for gamete banking. No studies have yet been done to find the most effective methods of preserving the semen. Delta smelt sperm activates with fresh water. This study was done to find the concentration of Hank's Buffered Saline Solution (HBSS) that would prevent sperm activation (allowing sperm sample extension and cryopreservation and use at a later date) with the least detrimental effects. Fresh *H. transpacificus* semen samples (0.1 uL) were added to HBSS buffered solution (10uL; 100 - 800mOsm) to find the lowest mOsm that prevented activation. Observations were done under a dissecting microscope. An estimate of percent sperm activated and duration of activation was recorded for each solution. In addition, semen samples were added to several HBSS concentrations and then flushed with distilled water to investigate how time spent in the buffer (0, 5, 10, 20 and 30 seconds) would affect sperm activation. The threshold for sperm activation was between 600mOsm and 700mOsm, and sperm held in HBSS for 6 days had an average 66 percent drop in activity and duration. Direct microscopic examination of sperm with additional buffers and cryopreservation agents will help elucidate best agents for long and short-term storage of delta smelt sperm.

Key Words - *delta smelt: sperm storage*

Theme: Biological Species

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Spatial Analysis of Fall Midwater Trawl Trends for Delta Smelt

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The spatial distribution of delta smelt (*Hypomesus transpacificus*) during the fall can vary significantly depending on Delta outflow, and is thought to be a seasonal determinant of habitat quality and quantity for the species, as well as a potential factor influencing subsequent summer abundance. The Fall Midwater Trawl (FMWT) index, which is a widely relied upon measure of fall delta smelt abundance, does not explicitly describe variations in spatial distribution. As a result, potential information about delta smelt spatial patterns of occurrence and their response to changing outflow is not fully utilized. We conducted analysis of FMWT trends from a spatial perspective using GIS tools and spatially explicit statistical methods. The objectives were to identify fall patterns of delta smelt distribution and improve understanding of the influence of abiotic drivers on the distribution. We examined how spatial clustering of delta smelt varied with historical outflow and salinity conditions including periods of high versus low abundance, and pre- and post- *Corbula amurensis* invasion. A set of hydrodynamic simulations was conducted to determine how salinity spatial patterns responded to outflow changes from different water management scenarios, which in turn allowed estimates of expected potential changes to delta smelt distribution. We found that spatial clustering of delta smelt occurred further up estuary during periods of higher salinity. We found that higher fall delta outflow resulted in salinity conditions historically more conducive to a broader geographical extent of delta smelt distribution, which included more substantive occurrence in the larger embayments of the estuary. We identified spatial station aggregates that demonstrated similar catch patterns across varying salinity conditions. The relationship between fall outflow and subsequent abundance can now be refined using an alternate set of spatially aggregated stations which have demonstrated statistically significant patterns of catch.

Key Words - *delta smelt; FMWT; X2; habitat quality; water management*

Theme: Biological Species

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The role of herbivory by *Branta canadensis* (Canada Geese) in the annual life cycle of a San Francisco Bay *Zostera marina* (Eelgrass) population

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Annual seagrass populations are those in which plants complete in one year a full lifecycle, seed germination to flowering and seed set, followed by mortality. Among San Francisco Bay *Zostera marina* (eelgrass) populations there is one known annual eelgrass bed, at Crown Beach in Alameda. With the exception of a thin band of deeper plants, the majority of this relatively shallow 300-acre bed emerges as seedlings in February and March, flowers in late summer and is absent by December. Previous studies of annual beds suggest that abiotic stresses drive the annual life history expression. However, not all the plants in the annual Crown Beach bed flower before disappearing, and observations of intense herbivory by *Branta canadensis* (Canada Geese) prompted a hypothesis that grazing might be more important in inducing the annual life cycle of this population than abiotic factors. We used field plots, half which were caged to exclude Canada Geese, at two elevations (0.0m MLLW and -1m MLLW), to test the effects of both exposure and herbivory on plant growth and persistence. Our results show that excluding geese allowed plants to persist through the winter months and continue clonal growth at both elevations. Uncaged (control) plots followed previously observed mortality patterns, with all plants absent by November. A tidal simulator experiment to further evaluate exposure effects showed no significant difference between plants that experienced exposure during low tides and plants that were grown at a constant depth, nor did any of the plants exhibit an annual life history. Our results indicate that intense fall herbivory by Canada Geese is a predominant cause of the annual lifecycle observed in the shallow regions of the Crown Beach eelgrass bed. Although grazing in temperate seagrass beds by waterfowl is well documented in the literature, this is the first study to experimentally establish waterfowl herbivory as a major driver of seagrass life history strategy.

Key Words - *Zostera marina*, eelgrass, *Branta canadensis*

Theme: Biological Species

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POSTER ABSTRACTS

Napa River Smolt Monitoring Program

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The Napa County Resource Conservation District initiated a salmonid outmigrant monitoring program in 2009 using a rotary screw trap. This program represented the first outmigrant trapping effort ever undertaken for the Napa River basin. A group of over 30 volunteers assisted with installation, daily processing, and maintenance of the trap, which was located in the mainstem Napa River north of Trancas Avenue (~400 meters upstream of the extent of tidal influence). Sampling extended from March 17 to May 26, 2009 (69 days). A total of 22 fish species were captured (12 native, 10 exotic). The total catch was 6,566 fish with an additional 48,950 larval specimens (Cyprinid and Catostomid species).

Native species dominated the total catch (n=6,523), comprising 99% of all non-larval specimens. A total of 1,059 steelhead (*Oncorhynchus mykiss*) were captured, including 119 smolts and 940 fry. Capture of steelhead fry (20-50 mm FL) indicates local spawning in the lowest reaches of the non-tidal Napa River, which had not been documented prior to this study. Genetics samples were collected from 123 steelhead for analysis by NOAA Fisheries. A total of 69 steelhead were marked and released upstream to determine trap efficiency. Only one fish was recaptured, yielding an estimated efficiency of 1.45%; however there is low confidence in this estimate given the relatively small release group size. One Chinook salmon (*Oncorhynchus tshawytscha*) smolt (FL=90mm) was captured and released. A genetics sample was collected from this specimen for comparison with cohorts from previous years. The average steelhead smolt length was 178mm, which suggests Napa River steelhead smolts tend to be large and therefore likely experience relatively high marine survival.

The Napa RCD and its partners plan to operate the trap annually to develop salmonid population estimates and track ecological responses to ongoing habitat restoration.

Key Words - *smolt; steelhead; salmon; chinook; outmigrant; rotary; screw; trap; napa*

Theme: Biological Species

Poster Board Number: 30. **Submission Number:** 96

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Midwater Trawl Mouth Geometry Evaluation

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The Fall Midwater Trawl (FMWT) and San Francisco Bay Study (Bay Study) surveys use a midwater trawl net (MWT) to sample age-0 fish abundance and distribution within the San Francisco Estuary. Fish density (precursor to abundance) is calculated as catch-per-unit-effort (CPUE): $CPUE = (\text{catch} / \text{volume sampled}) * 10,000$. Volume sampled is the product of the net-mouth area (assumed to open 80% of maximum net-mouth area or 10.7 m²) and distance traveled by a flowmeter, approximating net travel through the water column. The net has a fully-opened mouth area of 13.7 m². This study documented MWT mouth area during standard 12 minute tows, for two different deployment lengths – 30.5 m (100 ft) and 91.4 m (300 ft) of cable out – and measured gear depth at the longer deployment length. Sampling was conducted from the FMWT's RV Scrutiny and Bay Study's RV Longfin using standard protocols. Throughout test deployments, custom-made acoustic "responders" affixed to each net-mouth corner initiated and received signals that were converted into records of 6 net-mouth dimensions as well as mouth area. With 30.5 m of cable out, the average net-mouth area measured from the RV Scrutiny was 10.9 m² and from the RV Longfin was 9.1 m². With 91.4 m of cable out, average net-mouth area measured from the RV Scrutiny was 11.7 m² and from the RV Longfin was 9.4 m². Average maximum gear depth with 91.4 m of cable deployed from the RV Scrutiny was 10.8 m and from the RV Longfin was 10.1 m; average channel depth was 12.5 m. Although the average net-mouth area was consistent with the previously calculated estimate, the area decreased markedly during the last one-third of the tow during net retrieval. This mouth area decrease has implications for fish density and abundance calculations for both surveys that are being investigated.

Key Words - *midwater; trawl; net mouth; area*

Theme: Biological Species

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Effects of Contact and Oral Exposure to Formulated CheckMate® LBAM-F and Unformulated LBAM Mating Pheromones on Honey Bees, *Apis mellifera* (Hymenoptera: Apidae)

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A new invasive pest has entered center stage for California, the light brown apple moth (LBAM) (*Epiphyas postvittana*), which is known to feed on 2,042 host plants, many of which are agricultural crops, ornamental garden exotics, and native California species. The USDA in conjunction with the CDFA has launched an aggressive eradication program to stop LBAM before it spreads and becomes permanently established. To avoid the use of toxic chemical pesticides, the CDFA chose to employ a mating disruption strategy using LBAM pheromones. The mechanism by which the pheromone product, Checkmate LBAM-F® (Checkmate), disrupts reproduction is not understood by the general public who fear adverse effects from its use. In light of drastically declining honey bee populations, public fears prompted the CDFA to investigate the potential toxicity of Checkmate to honey bees. Potential toxicity from both contact and ingestion exposure were evaluated using Checkmate at rates up to 10 times the actual field application rate. Newly emergent honey bees were either hand sprayed at close range or fed a proteinaceous pollen substitute mixed with Checkmate, over a seven day period. Mortality was recorded, and food consumption measured at the end of the tests. Ten replicates were run for each trial, with 30 bees per chamber. Both ingestion and contact test results found Checkmate to be non-toxic to honey bees even when exposures were 10x the field application rate. Bee behavior was not affected from having been sprayed with Checkmate. The main scientific management implication of our findings is that use of the LBAM control product Checkmate® LBAM-F, should not be curtailed due to fears of harmful effects to honey bees.

Key Words - *Honey bee; toxicity; Checkmate® LBAM-F*

Theme: Biological Species

Poster Board Number: 35. **Submission Number:** 235

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POSTER ABSTRACTS

Larval delta smelt behavior in response to physical stimuli using small raceway

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Little is known about the swimming behavior of Delta Smelt, *Hypomesus transpacificus*, a small pelagic fish endemic to the upper Sacramento-San Joaquin Delta estuary (or “Delta”) in Northern California, USA. The species has been characterized as utilizing swimming behavior to maintain position in the Low-Salinity Zone (LSZ). Previous studies have shown that Delta Smelt undergo near surface migrations during daylight hours and utilize depth during nighttime (Bennett et al. 2002). The objective of this study was to investigate swimming behavior in a small raceway to inform modeling and management efforts addressing larval movements through the delta. Studies were designed to develop a better understanding of larval delta smelt movements in response to physical stimuli: light (0-200 $\mu\text{mol}/\text{m}^2/\text{sec}$), food (prey density of 0-100/L), water current, and turbidity. A clear Plexiglas raceway is constructed with three adjacent channels (55 in long x 7.25 in wide 2.25 in high) fitted with vertical sliding gates to document presence absence of fish in five stations within each channel at a given time interval (15-30 fish/raceway channel/run). Results indicate that 1 and 2 week old delta smelt exhibit a positive photo tactic response to the area of highest light level. When turbidity is added to area in which larvae are acclimating and light stimulus is at opposite end of raceway, the response time to light is increased in 1-week old larvae, but not in 2-week old larvae. Results suggest that neither food nor turbidity slow down 3 week old larvae’s response to light. Additional turbidity studies are being conducted on various life stages of Delta Smelt to investigate their swimming behavior.

Theme: Biological Species

Poster Board Number: 21. Submission Number: 136

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POSTER ABSTRACTS

Linking the San Francisco Bay Joint Venture Project Tracking System to Monitoring Data at PRBO's California Avian Data Center

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The goal of the San Francisco Bay Joint Venture (SFBJV, www.sfbayjv.org) is to protect, restore, increase and enhance all types of wetlands, riparian habitat and associated uplands throughout the region to benefit birds, fish and other wildlife. The SFBJV Project Tracking System (PTS), developed and maintained by Ducks Unlimited (DU, www.ducks.org), organizes detailed project information from JV partners and includes digital site maps. Since SFBJV goals, planning and actions are driven by science-based information, the incorporation of bird population information into the JV PTS provides the basis for an adaptive management framework, critical as we develop and assess habitat restoration and enhancement projects. To address this need, the SFBJV, Central Valley Joint Venture, Ducks Unlimited and PRBO Conservation Science (PRBO, www.prbo.org) recently agreed to forge links between the PTS and PRBO's California Avian Data Center (CADC). CADC is a regional node of the Avian Knowledge Network currently managing > 48 million bird observations spanning > 40 years. Its goal is to make timely and relevant scientific data and analyses readily accessible to habitat managers, policy makers, conservation practitioners, researchers, students, and the public. The new link between the PTS and CADC's bird monitoring data allows JV users access to current bird information such as occurrence, abundance, species richness, and population trends using a combination of PRBO point count, banding, nesting and shorebird survey data, California eBird (citizen science) data, Breeding Bird Surveys and other datasets. Users of the SFBJV PTS can jump from the project information web pages to a matching web page at CADC to view bird information collected in the vicinity of the SFBJV project locations of interest. Improvements to the new system will be implemented in the coming months and a similar project is planned for the Central Valley Joint Venture.

Key Words - *Joint Venture, birds, habitats, science, monitoring, database*

Theme: Biological Species

Poster Board Number: 34. **Submission Number:** 242

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POSTER ABSTRACTS

Salt Marsh Harvest Mouse Studies in the South San Francisco Bay Region

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The salt marsh harvest mouse, *Reithrodontomys raviventris*, has been shown to utilize the deep thatch layer of mature alkali bulrush (*Schoenoplectus robustus*) in brackish marshes in the South San Francisco Bay, similar to the situation found in mature, brackish marshes in the Suisun Bay. Mice were often scarce when trapped at the mud surface but were more numerous when the traps were set on top of the thick thatch of mature bulrush marshes during high tides. Brackish marshes may be of greater conservation value to the mouse in the South San Francisco Bay than previously thought but further studies will be needed to ascertain how valuable they are. While brackish marshes have expanded in the last hundred years the broad high tidal marsh zones of salt marshes that the mice use as escape cover during high tides have been greatly reduced, i.e. to bands of vegetation 1 to 3 meters deep in 45% and a meter or less in 35% of the edge of the South San Francisco Bay's salt marshes. Upland vegetation is adjacent to only 5% of the salt marshes. We have identified a strong relationship between marsh width and mouse numbers and suggest that narrow fringing marshes, and especially those with little to no adjacent high marsh, may act as filters or barriers to mouse movement. We also suggest that there are more and smaller populations and less genetic interchange between populations of the mouse than previously assumed.

Key Words - *Salt marsh harvest mice; brackish marshes; population numbers; high marsh zones*

Theme: Biological Species

Poster Board Number: 31. **Submission Number:** 78

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POSTER ABSTRACTS

Growth and survival of delta smelt fed field-collected copepods

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Populations of planktivorous fish in the San Francisco Estuary (SFE) are in a state of decline. Declines in some species have been correlated to changes in the abundance and distribution of their zooplankton prey. Over the past two decades, there has been a shift in the species composition of zooplankton from a community dominated by calanoid copepods to one dominated by a single introduced cyclopoid copepod, *Limnoithona tetraspina*. Since its introduction, *L. tetraspina* has become the most abundant copepod in the brackish regions of the SFE, at times outnumbering all other species by a factor of ten. However, because the mass of an individual *L. tetraspina* is approximately 1/10th that of the historically dominant calanoid species in this region, *Eurytemora affinis* and *Pseudodiaptomus forbesi*, the total biomass available to planktivorous fish has not changed. To test for an effect of prey type on growth and survival of delta smelt (*Hypomesus transpacificus*), we conducted long-term rearing trials with first-feeding (6 days old) and 30-day-old larvae. Each age-group was reared for 30 days on one of three diets (*L. tetraspina*, *P. forbesi*, or a combination of rotifers and *Artemia* sp. as a control diet, n=3). Field collected zooplankton were size fractionated appropriately for each age-group of larval fish tested. Each prey-size category was offered in excess but at relative densities similar to those observed in situ. Both age-groups of larvae grew faster (fork length) when fed *P. forbesi* than *L. tetraspina*; however, larval survival did not differ significantly among diets. This information supports claims that high abundances of *L. tetraspina* may provide suboptimal nutrition to the delta smelt population.

Key Words - *Delta smelt*; *Limnoithona tetraspina*; *Pseudodiaptomus forbesi*

Theme: Biological Species

Poster Board Number: 22. Submission Number: 137

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POSTER ABSTRACTS

Exploring Spatial Patterns in Fish Species Composition in Liberty Island

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In the early 1900's, Liberty Island, like many areas in the California Delta, was reclaimed from the delta to support agriculture. In 1997, the levees of Liberty Island were breached and left unrepaired. The Sacramento River has since influenced the island by reshaping the bathymetry, vegetation, and fauna. Liberty Island now resembles a tidally influenced floodplain located at the toe-drain of the Yolo Bypass; it is diverse in habitat and is thought to resemble the historical Delta prior to channelization, levee construction, and water diversions that began in the late 1800's. From 2003 through 2005, the Delta Juvenile Fish Monitoring Program conducted gill netting at Liberty Island to determine species composition, abundance, and distribution of adult-size fish. A large number of adult non-natives: white catfish, striped bass, carp, channel catfish, and threadfin shad were observed in addition to the native Sacramento splittail. Liberty Island was spatially assessed by dividing the island into four zones. Results from the gill net sampling showed no distinct patterns in species distribution between the four zones. As the restoration of Liberty Island continues, the conditions and fish communities will continue to change. These surveys provide valuable insights into the changing conditions of the island and how fish are utilizing available habitat to colonize the recently flooded area. Continued monitoring allows the state and federal water facilities to make informed decisions regarding pumping schedules in order to minimize the take of special status species.

Key Words - *spatial patterns; species composition; gill netting*

Theme: Biological Species

Poster Board Number: 29. Submission Number: 133

Our Actions, Our Estuary
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POSTER ABSTRACTS

Factors Controlling Spatial and Temporal Trends in Tidal Flat Shape in South San Francisco Bay

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South San Francisco Bay (SSFB) tidal flat morphologic change is examined, using 5 sets of bathymetric data collected by the USCGS, NOAA, and Sea Surveyors between the 1890's and 2005. The tidal flats are broken into geographically similar regions and multiple cross-sections are drawn across the extent of the tidal flats at close - ~50m - intervals, allowing for a determination of mean mudflat bathymetric profile in each region. Eigenfunction analysis is used to separate profile shapes into the dominant components of morphologic variability, which are compared to theoretical models for profiles as a function of waves, tides and sediment supply. Theory predicts that wave-dominated or sediment-starved flats tend to have concave-upwards bathymetric profiles; tide-dominated or accretionary flats tend to have convex-upwards bathymetric profiles. Eigenfunction scores that quantify the spatial pattern of convexity are correlated to spatial variability in fetch length, sediment grain size, recent erosion/deposition, and tidal height. Trends for morphologic change between 1890 and 2005 in twelve geographically diverse regions within SSFB are compared to temporal trends in sediment discharge, mean sea level, diurnal tidal range, and Pacific Decadal Oscillation Index (as a proxy for storminess). Overall, convex profiles were favored in the inner (south of Dumbarton) and concave profiles favored in the outer (north of Dumbarton) estuary throughout the entire historical period. Furthermore, tidal flat morphology of the outer estuary displayed a steady increase in concavity with time. The trend of increasing concavity in the outer-estuary flats was consistent with temporal changes in hindcasted sediment discharge from the Central Valley.

Key Words - *mudflat; tidal flat; shape; sediment; restoration; change*

Theme: Climate Change

Poster Board Number: 2. Submission Number: 202

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POSTER ABSTRACTS

Peat accretion and carbon sequestration rates in tidal marshes of the Sacramento-San Joaquin Delta, California

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Tidal freshwater marshes accrete peat and, in so doing, sequester carbon. These two functions are of increasing importance as new strategies are required to combat carbon pollution, and the sustainability of marsh habitats are threatened by sea-level rise. The goal of the CALFED-funded REPEAT project was to study peat formation processes over the millennia in marshes of the Sacramento-San Joaquin Delta of California. Peat cores were collected in two high-energy sites, a main channel and the confluence of two rivers, highly influenced by watershed processes, and two sheltered sites, along low-energy tributaries of rivers, largely removed from watershed processes. Bulk density (BD), % organic matter (OM), and % organic carbon measurements and radiocarbon dating were conducted on samples throughout all four cores. Spline fit age-depth models were constructed with the radiocarbon results. The data showed that despite considerable temporal variability in the high energy sites, they had greater BD and lower OM than the sheltered, low energy sites. Mean vertical accretion rates in each of the marshes over the past 6000 years ranged between 0.12 - 0.18 cm yr⁻¹. Mean carbon sequestration rates over the millennia ranged between 80 - 180 g m⁻² yr⁻¹. For both vertical accretion and carbon sequestration, higher rates were found in the high-energy sites than the low-energy sites. The main determinant of the total amount of carbon stored was the accretion rate, however, this might not necessarily be so in other tidal marsh regions. Scientists and managers interested in increasing carbon sequestration through wetland restoration need to consider vertical accretion rates, carbon sequestration rates, and long-term marsh sustainability in order to choose sites with the highest potential for success.

Key Words - *carbon sequestration; marsh; peat; sea level rise; vertical accretion*

Theme: Climate Change

Poster Board Number: 5. **Submission Number:** 55

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POSTER ABSTRACTS

Modeling the Effects of Sea-Level Rise on the Flow and Waves in South Bay, San Francisco, California.

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Global warming is expected to result in a sea-level rise in San Francisco bay of 55 inches (1.4 m) by the end of the century putting an estimated 270,000 people and an estimated \$62 billion in economic value at risk of flooding (BCDC, 2009). Knowles (2008) presents a comprehensive analysis of future inundation due to sea-level rise in the bay area. The research presented on this poster focuses on the effects of sea-level rise on tidal propagation, waves, and currents in the South Bay. The Delft3D model system is used. Validation of the model shows that the main characteristics of the tidal motion are reproduced. Model results for various scenarios of sea-level rise illustrate a near-linear response in South Bay in the water levels for sea-level rise scenarios between 0.5 and 5 m. For a 1.40 m sea-level rise scenario (BCDC, 2009) large flow velocity increases occur south of Dumbarton Bridge where the effects of inundation were most pronounced. Near the Golden Gate, along the San Francisco waterfront, and towards Oakland harbor flow velocity magnitudes locally increase up to 10%. Sensitivity simulations assessing the effects of sea-level rise on wave generation, using a range of wind speeds (5-25 m/s) and directions (0 - 260°), illustrate up to 0.50 m increases in wave heights at key locations. Largest increases are observed on tidal flats areas. Besides the well-known problem of inundation, this study points to the possible important effects of increased flow velocities and augmented wave heights, that might pose a hazard for recreational and commercial shipping, and could induce (increased) erosion of the tidal flats.

Key Words - *sea-level rise; numerical modeling; South Bay*

Theme: Climate Change

Poster Board Number: 4. Submission Number: 221

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POSTER ABSTRACTS

Bathymetry and acoustic backscatter of the mud flats between the Dumbarton Bridge and the Hetch-Hetchy Aquaduct, South San Francisco Bay, California

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On 8 December 2008, 9 February 2009 and 8 April 2009 the USGS conducted hydrographic surveys of the western mud flats between the Dumbarton Bridge and the Hetch-Hetchy aqueduct. The surveys are part of a multi-year program designed to establish baseline bathymetry for the study area and to monitor seasonal geomorphic change and the effects of salt pond restoration. The surveys were conducted using the state-of-the-art research vessel R/V Parke Snavely outfitted with an interferometric sidescan sonar for swath mapping in extremely shallow water. Favorable survey conditions prevailed throughout the first three surveys and the system was able to map in 1.5 m water depth; collecting 10 m to 15 m swaths of bathymetry and acoustic backscatter with as little as 30 cm of water under the transducers. The data from each survey were binned on a 1-m grid and had 95% vertical uncertainties on the mud flat and main channel of 0.20 m; 0.18 m and 0.16 m for the December, February and April surveys, respectively. No statistically significant differences in bathymetry were detected between the average mudflat depth suggesting that mean geomorphic change in the mud flat between December 2008 and April 2009 was below the detection threshold of the mapping system. When the three surveys were stacked together (to average out system noise), the uncertainty in the seafloor bathymetry drops to 0.12 m at 95% confidence---close to the theoretical limit of this sonar mapping system. Unlike the bathymetry, the acoustic backscatter showed a variation between the first two surveys. In the December 2008 survey, the lower third of the mud flat had anomalously bright acoustic returns with no expression in the bathymetry. In spite of its large size, the feature disappeared from the backscatter in subsequent surveys. At this point, the nature of the feature and its geomorphic significance is unknown.

Key Words - *mudflat; tidal flat; mapping; sediment; restoration; change*

Theme: Climate Change

Poster Board Number: 1. Submission Number: 194

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POSTER ABSTRACTS

What have we done to the Bay? Anthropogenic impacts on net sediment volume change in Central San Francisco Bay, 1855 – 1979

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Understanding the patterns and quantities of sediment deposition and erosion in Central San Francisco Bay is not possible without accounting for the many anthropogenic alterations made to the system. Dredging, dredge disposal, the use of bay sediment for construction, and sand mining are detectable in the series of five bathymetric surveys from 1855 to 1979. During this time period approximately 50 million cubic meters of sediment were removed from the system.

The first federally recognized dredging project for navigational purposes, Oakland Harbor, was authorized in 1874. Since that time there have been approximately 17 locations within Central San Francisco Bay that have been maintained by dredging. Of the documented 56 million cubic meters dredged, approximately 37 million cubic meters of sediment can be quantified by our study.

Dredge disposal went unregulated up to 1972, but depressions southwest of Alcatraz Island and southwest of Yerba Buena Island were used often. During the period from 1985 to 1920, we calculate that these two areas gained approximately 16 million cubic meters of sediment.

The removal of sediment and the creation of borrow pits strictly for use in development is first noted in 1935 with the construction of Treasure Island for the Golden Gate International Exposition 1939—1940. This undertaking required 22.5 million cubic meters of sediment taken from within Central San Francisco Bay.

Sand mining in San Francisco Bay started in the late 1800s and continues to date and always results in a loss of sediment from the system. In the sand mining lease areas, there was a net loss of 6 million cubic meters of sediment from 1947 to 1979.

It is possible to estimate the volume of sediment affected by dredging and other activities using bathymetric change grids. Although it may be difficult to separate the sediment volume change associated with anthropogenic activities from those associated with natural changes in deposition and erosion, it is important to do so. From 1947 to 1979, of the 50 million cubic meters of sediment lost from Central Bay, we estimate approximately 60 % was removed by anthropogenic activities.

Key Words - *Anthropogenic, Sedimentation*

Theme: Climate Change

Poster Board Number: 3. Submission Number: 169

Our Actions, Our Estuary
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POSTER ABSTRACTS

Youth Understanding Water Resource Systems in the Face of Climate Change

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Problem: Lack of understanding and considerable misconceptions among youth on how water flows through and is used by their communities, how that usage affects the health of downstream ecosystems, and how climate change may affect local water systems. **Approach:** UC Davis John Muir Institute of the Environment's public education programs seek to disseminate knowledge, correct misconceptions, and change behaviors and attitudes of school-aged youth about water in the face of climate change. A variety of in- and out-of-school water education programs in Yolo and Solano Counties establish the connection between upstream watershed actions and downstream San Francisco estuarine consequences. To close the gap between generalized knowledge and lived experiences, our programs trace the path of water through our sub-watersheds in interactive activities using familiar places, everyday actions, and contextualized examples. Understanding "how water works" in turn allows youth to accurately predict the consequences of their actions on the local watershed and the San Francisco Estuary as the repository of the entire watershed's runoff. Finally, our programs support personal and community action projects in pursuit of protecting the natural resource most endangered by climate change, water. **Findings:** Feedback from educators and surveys with youth indicate that youth demonstrate marked improvement in understanding water systems and the implications of their actions after participating in our programs. For example, comparison of pre- and post-responses revealed that youth misconceptions about the sources and destinations of their water decreased and, conversely, their content knowledge about their watershed and an awareness of the need for water conservation increased. **Implications:** Public education programs can provide youth with a comprehensive understanding of water and the experience of being problem-solving resource protectors. This builds confidence, knowledge, and self-efficacy that youth can make a difference in the health of aquatic systems in the uncertain era of global climate change.

Key Words - *youth; education; watershed; climate change*

Theme: Climate Change

Poster Board Number: 11. **Submission Number:** 254

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POSTER ABSTRACTS

**The effects of local climate variation on heron and egret nesting activity:
implications of climate change**

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Changes in the structure and composition of wetland systems as a consequence of rising global temperatures have been predicted, yet little is known about how these changes might alter the activities or roles of top wetland predators. Herons and egrets are important wetland predators that breed and winter throughout the San Francisco Bay area. Winter rainfall enhances the extent of seasonal wetland feeding areas for herons and egrets, but heavy winter weather may also reduce prey availability and foraging efficiency. Therefore, climate variation might enhance or reduce the availability of food needed for nesting and the survival of juveniles during their first winter. In addition, intra-seasonal thresholds in prey availability have been associated with the timing of nest initiations, and herons and egrets are known to delay nesting in response to extended (late) winter rainfall. We investigated variation in heron and egret nesting performance and abundance in relation to climate variation, over 19 years at all known nesting colonies in the northern San Francisco Bay area. We measured local climate variation using annual and monthly rainfall and temperature estimates generated by the PRISM Climate Group, Oregon State University. Response variables included the timing of nest initiations, net local and regional nesting recruitment, nest survivorship, and the productivity of successful nests. Our results revealed rainfall effects on annual variation in regional nesting abundance and suggested that local climate variation may be related to annual shifts in nesting distribution and abundance. We used these results to consider the implications of long-term climate change on the regional nesting activities of herons and egrets and changes in the structure of regional wetland systems.

Key Words - *climate change; wetlands; Great Blue Heron; Great Egret;*

Theme: Climate Change

Poster Board Number: 7. Submission Number: 170

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POSTER ABSTRACTS

Long-term trends in nutrient and chlorophyll-a concentrations in the Central San Francisco Estuary, CA

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Estuarine environments exhibit large seasonal and interannual changes in nutrient and chlorophyll-a concentrations as a result of variable flow conditions and phytoplankton activity. In the San Francisco Estuary (SFE), freshwater flow is a critical driver of this variation and is likely a determinant of the timing and magnitude of spring blooms. High concentrations of nutrients occur in the estuary, at non-limiting eutrophic levels; with elevated ammonium levels probably from anthropogenic sources. This eutrophication (e.g. high dissolved inorganic nitrogen) does not result in the negative side effects common in other estuaries (anoxia and harmful algal blooms) but may instead influence the food chain for sensitive upper trophic level organisms that rely on phytoplankton. Long-term records of key chemical and biological parameters paired with river discharge provide insight into potential biogeochemical impact from perturbations in freshwater flow due to changing climate and water diversions. Here we describe variation in nutrients and extracted chlorophyll-a during the spring period using a 6-yr time series from the most seaward embayment of the SFE, Central San Francisco Bay. With close proximity to the ocean, nutrients and chlorophyll-a in Central Bay appear to be modulated by variations in freshwater flow, particularly in spring during anomalously wet and dry years. High flow conditions lead to water column stratification, mobilize non-point nutrient sources, and potentially dilute point source nutrients. Insights gained from this analysis may help elucidate the links between climate and increased water demand on biogeochemical functioning of major estuarine systems.

Key Words - *climate change, phytoplankton, nutrients, chlorophyll*

Theme: Climate Change

Poster Board Number: 10. Submission Number: 148

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POSTER ABSTRACTS

Assessing the effects of climate change and globalization on the pathways of species invasion in the San Francisco Bay/Sacramento-San Joaquin River Delta Ecosystem

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Globalization and new technologies of the past half-century have increased by orders of magnitude the speed, frequency and types of pathways by which non-native invasive species (NIS) introductions occur. The San Francisco Bay, known as the “most invaded ecosystem”, has a new NIS introduced every 14 weeks (Cohen and Carlton 1998) with many of these introductions arriving in ballast water. Introduced by ballast water to the Great Lakes in the mid 1980’s, quagga and zebra mussels rapidly spread throughout many major rivers, via trailered boats, including the Colorado River, and reaching Southern California in 2006. Both examples illustrate how our global and mobile society has aided in the transport of NIS.

Climate change is likely to exacerbate the already complex NIS problem. Increases in atmospheric carbon dioxide and global temperatures lead to changing precipitation patterns and a whole realm of other environmental factors that will cause stress in ecosystems which may allow NIS to expand their distribution range. Natural resource managers need tools to help prevent, control and manage NIS. As a starting point for assessment, Hellmann et al (2008) identified five potential consequences of climate change for NIS: (1) altered pathways, (2) altered environmental constraints, (3) altered distribution, (4) altered impact, and (5) altered management effectiveness.

The most practical approach to prevention and control is eliminating the pathways, or means and routes by which NIS are introduced and developing methods to reduce the risk of spreading all species that have “access” to these pathways. Assessing the invasive pathway as a starting point for gauging the potential consequence of climate change and globalization for NIS may help land and water managers in the Bay-Delta develop strategic plans to combat the growing threat of NIS

Key Words - *invasive species; climate change; pathways*

Theme: Climate Change

Poster Board Number: 8. Submission Number: 183

POSTER ABSTRACTS

Modeling the Impacts of Climate Change and Reduced Freshwater Flows on San Francisco Bay-Delta Wetlands and Their Associated Plant and Animal Communities

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Climate change and population growth will both impact future water inputs to the San Francisco Bay-Delta. Climate change will shift the timing and amount of seasonal freshwater inputs and will increase water levels and push saline water farther into the estuary via sea-level rise. Population growth will cause greater freshwater diversions, exacerbating impacts of climate change. As a result of these changes and increased summer temperatures, Bay-Delta wetlands will experience increased summer salinities and increased inundation rates. These wetlands perform important ecosystem services, including providing habitat for endangered species and recreationally important fishes, sequestering carbon, and improving water quality. We have initiated a multi-year study evaluating the effects of climate change on marsh dynamics, concentrating on the effect of salinity and inundation regimes and modeling how changes in these factors associated with climate change will impact Bay-Delta wetland ecosystems. We are investigating plant distributions, decomposition and productivity, sediment accretion, and food web dynamics across the estuary. Freshwater inputs clearly structure plant communities as freshwater marshes have higher rates of both diversity and productivity (>60 species, 2440 g m⁻² y⁻¹) than brackish (24-50 species, 900-1400 g m⁻² y⁻¹) or salt marshes (10-17 species, 270-700 g m⁻² y⁻¹). Measurements of sediment accretion and plant decomposition rates indicate greater importance of mineral versus organic matter contributions to marsh accretion as freshwater inputs decrease. Preliminary $\delta^{15}\text{N}$ and $\delta^{13}\text{C}$ stable isotope data suggest a dependence of resident fishes on the productivity of specific assemblages within marshes, suggesting that pelagic consumers will be impacted by changes in marsh plant communities in response to changes in freshwater flows, salinity, and inundation. Although climate change impacts on Bay-Delta wetlands will be unavoidable, careful management that maintains freshwater flows into the estuary will be critical to preserving these ecosystems and the diversity of services they provide.

Key Words - *Climate Change; Plant Communities; Food Webs; Accretion*

Theme: Climate Change

Poster Board Number: 6. Submission Number: 203

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POSTER ABSTRACTS

Managed Shoreline Realignment in San Francisco Bay

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The low-lying San Francisco Bay shoreline is exposed to the risk of flooding and erosion with the magnitude and frequency of these events likely to increase due to accelerated sea level rise (Pacific Institute, 2009; PWA, 2009). Protecting the shoreline using traditional methods, such as “hard” shoreline armoring, is expected to incur adverse effects on the natural shoreline and ecosystems, constraining the natural evolution of beaches, mudflats, and salt marsh (Caldwell, 2007). These traditional methods are a short-term solution to protecting property and infrastructure on a dynamic Bayshore, where erosion and deposition produce continually changing geomorphic features. A more sustainable alternative is to work with the dynamic Bayshore and move development and infrastructure away from erosion and flood hazards and allowing evolution over time, a process of “managed retreat” or “managed realignment.” Managed realignment presents a long-term solution which allows the shoreline to evolve over time, yet continues to protect property. While managed retreat does not preclude the use of hard armoring, the realignment of levees and removal of artificial bay fill has several benefits: natural Bayshore processes are allowed to continue, levee size is reduced for the same level of protection, and future risk of damage is reduced. Discrete shoreline setbacks will play a major role in land-use planning to provide a buffer in zones of erosion and flood hazards. Examples of the application of managed shoreline realignment in the San Francisco Bay area will be presented.

Key Words - *managed shoreline retreat; managed shoreline realignment; setback; sea level rise*

Theme: Climate Change

Poster Board Number: 9. Submission Number: 213

Our Actions, Our Estuary
9th Biennial State of the San Francisco Estuary Conference
POSTER ABSTRACTS

Peat Deposits within the Sacramento–San Joaquin Delta: Timing of Anthropogenic Mercury and Lead Contamination

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Vertical peat profiles from Browns Island, a tule-dominated, brackish marsh within the Sacramento-San Joaquin Delta, contain higher concentrations of inorganic anthropogenic contaminants, including mercury (Hg) and lead (Pb), in the shallow recently deposited peat compared to underlying, older peat. In the top 65 cm of the profile, where peat was deposited since about 1850 CE (common era, equivalent to A.D.) based on ¹³⁷Cs data, Hg and Pb concentrations were (average ± 1 standard deviation) 320 ± 220 nanograms per gram (ng/g, dry) and 42 ± 17 micrograms per gram (µg/g), respectively. In contrast, Hg and Pb concentrations were 42 ± 12 ng/g and 7 ± 4 µg/g, respectively, in deeper material deposited between about 6,300 and 500 calibrated years before present (cal yr BP), based on radiocarbon dating of macrofossils and charcoal. In the peat of transitional age (500 to 100 cal yr BP), when global or regional anthropogenic effects may have occurred, Hg and Pb concentrations were 106 ± 38 ng/g and 9 ± 5 µg/g, respectively. Lead isotope ratios ²⁰⁶Pb/²⁰⁷Pb and ²⁰⁸Pb/²⁰⁷Pb, determined from acid digests of bulk peat, indicate a systematic shift towards less radiogenic Pb isotope ratios starting approximately 450 cal yr BP (1,500 CE). This shift is accompanied by increased Hg concentrations and predates influence of organolead gasoline additives. These data may reflect increased mining and metallurgical activity in Mexico after European colonization, or increased global fluxes of Pb and Hg from China and (or) Europe associated with industrialization. Observed decreases in Hg and Pb concentrations normalized by Ti (to correct for variable inorganic content) during the most recent 25–35 years of deposition (post-1970 for Hg, post-1980 for Pb) are consistent with decreasing global atmospheric fluxes of these contaminants in recent decades. Peat deposits represent a useful archive for trends in geochemical cycling.

Key Words - mercury, lead, anthropogenic effects, peat, Sacramento-San Joaquin Delta

Theme: Contaminants

Poster Board Number: 131. **Submission Number:** 127

Our Actions, Our Estuary
9th Biennial State of the San Francisco Estuary Conference
POSTER ABSTRACTS

Development of a Selenium TMDL for North San Francisco Bay – A complex puzzle in a dynamic system

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The North San Francisco Bay is identified as impaired by selenium, a pollutant that also occurs naturally in the Bay-Delta Estuary. The first listing on the Clean Water Act 303(d) list of impaired waters occurred in 1998 and identified all North Bay segments including the Central Bay segment as impaired by selenium. Anthropogenic sources of selenium to the Estuary include agricultural inputs to the San Joaquin River and refinery discharges. Despite implementation of actions to reduce these two sources taken during the last decade, San Francisco Bay biota have selenium concentrations higher than levels commonly associated with toxicity and reproductive impairment in fish and other wildlife species. Selenium concentrations are highest in species like white sturgeon feeding mainly on sediment-dwelling (benthic) organisms. Unfortunately, selenium bioaccumulation in Bay sturgeon has been both complicated and exacerbated by the introduction of the Asian clam (*Corbula amurensis*) into the Bay in 1986. These invasive clams are not only prodigious filter-feeders but they are very efficient in accumulating and retaining selenium, and they continue to thrive in the Bay. The selenium accumulated by these clams is, in turn, transferred to species like sturgeon whose diet contains an increasing proportion of these abundant bivalves. In addition, changing flow regimes in the Estuary due to adaptations to climate change and to address water supply issues will likely impact the fate of selenium in the system. The selenium TMDL project was initiated in 2007 to assess the current state of impairment in the North Bay, identify pathways for bioaccumulation, enhance our understanding of the relationship between sources of selenium and fish and wildlife exposure, develop site-specific water quality targets protective of aquatic biota and, and identify a strategy for attaining water quality standards. A principal component of the study is the development of a model to interpret the fate and transport of selenium in the North Bay and show the linkage between sources and water quality impairment. This work is showcased in a companion poster Modeling Selenium in North San Francisco Bay prepared by Limin Chen and others.

Key Words - *selenium; bioaccumulation; TMDL*

Theme: Contaminants

Poster Board Number: 138. **Submission Number:** 207

Our Actions, Our Estuary
9th Biennial State of the San Francisco Estuary Conference
POSTER ABSTRACTS

Potential effect of the herbicide Diuron on phytoplankton productivity and nitrogen uptake in the San Francisco Estuary

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Herbicides and other chemicals have the potential to negatively affect marine and aquatic ecosystems since rain and other factors flush them from the land and into the watershed. Diuron is an herbicide of concern in the northern San Francisco Estuary because it is heavily used for both agricultural and urban land, is relatively toxic, and is persistent in the environment. Despite its known presence in the SFE, little is known about Diuron's potential impact on pelagic primary production. Using stable and radioactive tracer techniques, a series of experiments were conducted to empirically determine the impact of elevated Diuron on primary production and nitrogen uptake by phytoplankton assemblages from the SFE. Results show reduced primary production with Diuron additions as low as 0.7 ug /L; these concentrations fall within the range of Diuron concentrations that have been previously reported for the northern SFE and Delta. Nitrate and ammonium uptake rates were also collected and show that Diuron inhibits nitrate uptake much the same as carbon. These findings highlight yet another potential contributor to the overall decline in estuarine productivity and may represent an important driver of the pelagic organism decline.

Key Words - *Primary Production; herbicide; diuron; contaminant; nitrogen uptake; phytoplankton*

Theme: Contaminants

Poster Board Number: 135. **Submission Number:** 120

Our Actions, Our Estuary
9th Biennial State of the San Francisco Estuary Conference
POSTER ABSTRACTS

The Potential for Endocrine Disruption in Suisun Marsh: response of a resident fish species to varied sources of estrogenic compounds

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Endocrine disrupting compounds (EDCs) are widespread in the environment and are known to damage the reproductive systems of fishes. Deleterious effects of estrogenic EDCs include the production of female reproductive proteins in male fish, reduced female egg production, altered behavior, and population decline. A large body of work exists on EDC effects in commonly used laboratory species (fathead minnow, medaka); however, fewer studies have considered resident species that inhabit areas of concern. One such ecosystem is Suisun Marsh in Solano County California, the largest contiguous brackish marsh remaining on the west coast of North America. This vital conduit between the San Francisco Bay and Sacramento / San Joaquin Rivers serves both as a nursery and as vital habitat for a number of threatened fish species. Our work utilizes the inland silverside (*Menidia beryllina*), a euryhaline resident fish of Suisun Marsh, as an indicator of EDC exposure. We are investigating whether marsh sites exposed to varied sources of estrogenic EDCs cause males to express the biomarker choriogenin, an egg shell protein normally found only in females that has been shown to be more sensitive than a frequently utilized indicator of exposure to xenoestrogens - vitellogenin (yolk protein). Results demonstrate that wild males collected from Suisun Marsh are expressing choriogenin, and data from an outplanting experiment conducted during the spring and summer of 2009 suggest that the level of expression at marsh sites is significantly greater than laboratory controls and is equivalent at sites exposed to treated wastewater effluent, urban run-off or ranch run-off. Histological examinations of gonads from wild fish are also being conducted to assess reproductive health. Chemistry conducted on water samples and on extracts from polyethylene devices (PEDs) from study sites will help to clarify these results and will identify estrogenic mixtures of concern to be used for confirmatory aqueous exposures in the laboratory.

Key Words - *endocrine disruption; bioindicator; fish; xenoestrogen*

Theme: Contaminants

Poster Board Number: 140. **Submission Number:** 232

Our Actions, Our Estuary
9th Biennial State of the San Francisco Estuary Conference
POSTER ABSTRACTS

Modeling Selenium in North San Francisco Bay

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This poster describes the application of a numerical model of selenium fate and transport in the North San Francisco Bay (NSFB), in support of the development of a selenium TMDL in this water body. The model application builds on a previously published application, and considers known point and non-point sources of selenium entering the bay, transport and mixing in the bay, and transformation and biological uptake. The model considers the behavior and uptake of different dissolved and particulate species. Dissolved species considered include selenate, selenite, and organic selenide. Particulate species considered include inorganic selenium (selenate plus selenite), organic selenide, and elemental selenium. Data on all these species is available for a set of sampling dates in the mid-1980s and late-1990s. The flows and selenium loads from the Sacramento and San Joaquin Rivers are dominant in the bay, although in the dry season, some of the point sources, such as refineries, can become more important. Dissolved selenium concentrations (all species combined) in the NSFB are generally low (~0.2 ug/l). However, selenium present in particulate forms in the water column of the estuary bioaccumulates in filter feeders, such as bivalves, and then into predator organisms that feed on these bivalves. Selenium-associated impairment in NSFB is largely a consequence of elevated concentrations in these predator organisms, specifically the white sturgeon and diving ducks. The modeling framework allows an examination of the relationship between selenium loads, in-bay concentrations, and biota concentrations to support TMDL development.

Key Words - *selenium; bioaccumulation; modeling; TMDL*

Theme: Contaminants

Poster Board Number: 137. **Submission Number:** 233

Our Actions, Our Estuary
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POSTER ABSTRACTS

A complete microbial community approach to tracking fecal pollution in coastal waters

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Current methods for assessing microbial water quality focus on only a few types of fecal indicator bacteria and have several shortcomings. Fecal matter contains thousands of microbial species that could potentially serve as more reliable and specific indicators. New methods of DNA sequence analysis enable rapid and simultaneous detection of thousands of microorganisms in a single sample. We are using a high-density oligonucleotide microarray to measure over 30,000 types of bacteria and archaea in fecal sources and track the fate of these microorganisms once they enter receiving waters. We tracked the 700,000 gallon sewage spill at the Sausalito-Marín City treatment plant in February 2009 and conducted a follow-up experiment using in situ diffusion chambers to determine the fate of all detectable sewage microorganisms in Richardson Bay. In addition, we used diffusion chambers to monitor microbial communities in septage and cattle waste once they entered fresh and marine waters around Tomales Bay. For each waste we identified groups of bacteria and archaea that persist or rapidly decay in receiving waters, and determined how these patterns of survival differed between freshwater and marine environments. The results provide new insight into the microbial ecology of these wastes and suggest dozens of new organisms that could be targeted for improved fecal indicator tests.

Key Words - *fecal indicator bacteria; microbial source tracking; sewage*

Theme: Contaminants

Poster Board Number: 143. **Submission Number:** 205

Our Actions, Our Estuary
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POSTER ABSTRACTS

Emerging Contaminants in Wastewater and Solids at the San Jose/Santa Clara Water Pollution Control Plant

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Recently, there has been significant media attention on the environmental fate, transport and effects of a broad class of compounds referred to as emerging contaminants. These include personal care products, pharmaceuticals and trace organics. The pathways, loadings, effects and persistence of these compounds in the environment are poorly understood. A critical first step to understanding the potential for environmental impacts of these compounds is to characterize and begin to quantify potential sources and pathways. One pathway some of these compounds travel into environmental media is through wastewater treatment plants (WWTPs). The San Jose/Santa Clara Water Pollution Control Plant (Plant) is a large, 167 MGD capacity advanced treatment WWTP located in South San Francisco Bay in California. City of San Jose staff collected wastewater and digested solids samples from three process locations (influent, effluent and digested solids) during three separate sampling events from the Plant. Aqueous and solids samples were analyzed for a suite of microconstituents to trace levels. Concentrations of Pharmaceuticals and Personal Care Products (PPCPs), Steroids and Hormones (STHM), and Polybrominated Diphenyl Ethers (PBDEs) were measured in all samples using EPA Methods. The primary objective was a basic characterization of emerging contaminants entering and leaving the Plant to provide information to wastewater managers and scientists. This information is valuable for public outreach, prioritizing future studies of emerging contaminants, and prioritizing pollution prevention or source control efforts. Of the 100 analytical endpoints measured in this study, 59 were either not detected or not quantifiable. Of the 41 quantifiable analytical endpoints, most (32) were removed or reduced at 75%-99% efficiency through treatment. Based on average Plant flows and concentrations at the three process points, staff calculated a preliminary estimate of mass balance for the quantified compounds and results are presented based on hypothesized removal processes.

Key Words - *Emerging contaminants; wastewater; biosolids; pharmaceuticals; steroids; hormones; microconstituents; San Jose; personal care products*

Theme: Contaminants

Poster Board Number: 142. **Submission Number:** 206

Our Actions, Our Estuary
9th Biennial State of the San Francisco Estuary Conference
POSTER ABSTRACTS

A Summary of Impacts to Natural Resources from the Cosco Busan Oil Spill

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State and federal trustee agencies have been assessing the ecological injuries caused by the Cosco Busan oil spill of November 2007. This process is known as natural resource damage assessment (NRDA). The goal is to quantify injuries to wildlife, habitat, and lost uses of those resources, and then to determine how to best restore the resources and compensate for the losses. This poster focuses on injuries to wildlife and habitat, and lost human recreational use. In the course of this NRDA, the trustees have conducted over 70 studies, as well as considered the results of studies done by others. This poster provides a summary of the results to date, specifically describing the impacts to birds, mammals, fish, rocky intertidal habitat, saltmarsh, mud and sand flats, sandy beaches, eelgrass beds, and human recreation. The ultimate goal of the trustees is to restore and compensate for the injured resources. The poster will also describe the processes to achieve this compensation, including upcoming public meetings and other opportunities to provide comment on proposed restoration actions.

Key Words - *Cosco Busan; oil spill; NRDA; natural resource damage assessment; restoration*

Theme: Contaminants

Poster Board Number: 134. **Submission Number:** 143

Our Actions, Our Estuary
9th Biennial State of the San Francisco Estuary Conference

POSTER ABSTRACTS

Removal of total and methyl mercury in island drain water of the Sacramento-San Joaquin Delta through coagulation with metal-based salts.

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The presence of mercury (Hg) and methyl mercury (MeHg) in surface waters of the Sacramento-San Joaquin Delta (Delta) is an ongoing issue facing state and local regulatory agencies. Previous studies that investigated Hg removal by metal-based coagulants concluded this method was not effective. However, a majority of these studies were published between 1970 and 1980, before the development of Hg-clean techniques, which required that samples were spiked with high concentrations of Hg. Given more recent understanding of Hg dynamics which have highlighted the critical role dissolved organic matter (DOM), plays in Hg solution chemistry, coagulation may indeed prove to be a viable technique to remove Hg from Delta waters. This study assessed whether coagulants effectively remove both inorganic Hg (IHg) and MeHg under ambient conditions and provides additional information regarding Hg associations with DOM and metal hydroxides. Three industrial-grade coagulants were studied: ferric chloride, ferric sulfate, and polyaluminum chloride. Water samples collected from Twitchell Island drainage waters were treated with a range of coagulant doses and analyzed for Total Hg (THg), MeHg and dissolved organic carbon (DOC) concentration and composition. In the absence of DOM, all three coagulants released Hg, however in the presence of DOM the coagulants removed up to 95% of THg, 97% of IHg, 80% of MeHg and 85% of DOC. The coagulants preferentially removed DOM with higher aromatic content, consistent with past studies. The ratio of Hg to DOC removed decreased with increasing coagulant addition, indicating preferential association of Hg with more aromatic DOM. Results from this study have regulatory and management implications regarding Hg control using metal-based coagulants in the Delta and other regions.

Key Words - *Mercury; inorganic mercury; methyl mercury; coagulation; dissolved organic carbon*

Theme: Contaminants

Poster Board Number: 129. **Submission Number:** 230

Our Actions, Our Estuary
9th Biennial State of the San Francisco Estuary Conference
POSTER ABSTRACTS

Uptake, Distribution and Excretion of Selenocompounds in Juvenile White Sturgeon (*Acipenser transmontanus*)

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Selenium (Se), an essential micronutrient to vertebrates, is an integral part of many antioxidant proteins and has the ability to interact with heavy metals. However, at a slightly elevated concentration, it is also a potent toxin. In the San Francisco Bay Delta, Se from anthropogenic sources biomagnifies through trophic levels via filter-feeders such as Asian clam and poses serious threat to aquatic predators. In the present study, a combined technique of stomach intubation, dorsal aorta cannulation and urinary catheterization was utilized to characterize the short-term kinetics of Se in the forms of selenate, selenite, selenocysteine (SeCys), selenomethionine (SeMet), Se-methylselenocysteine (MSeCys) and selenoyeast (SeYeast). An ecologically relevant Se dosage (500 ug/ kg body weight) was intubated in groups of five white sturgeons. Blood and urine were repeatedly collected over the 48 hr post intubation period and fish were sacrificed for tissue distribution at 48 hr. The uptake, distribution and excretion of Se significantly ($P < 0.05$) differ among forms. In general, organic selenocompounds maintain higher absorption with MSeCys maintaining the highest total Se absorption, storage (AUC) and Cmax in the blood. Regardless of source, Se is preferentially distributed into metabolically active organs with SeMet treated animals achieving the highest Se concentration in most tissues. Selenite has very similar uptake and tissue distribution profile to SeCys and SeYeast but Selenate is not stored in blood but rather rapidly taken up by the liver and white muscle. Urinary excretion of Se is form dependent and peak between 3-12 hr post intubation .

Key Words - *selenium; kinetics; white sturgeon*

Theme: Contaminants

Poster Board Number: 136. **Submission Number:** 199

Our Actions, Our Estuary
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POSTER ABSTRACTS

Sediment quality assessment in tidal salt marshes in northern California

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A sediment quality study was conducted in four tidal salt marshes in San Francisco and Tomales Bays (California, USA), utilizing a sediment quality triad (SQT) approach, which included measures of toxic chemicals, sediment toxicity, and benthic macroinvertebrate communities. Additional chronic toxicity indicators (e.g., apoptosis and histopathological damage in liver cells and embryo abnormalities in indigenous species such as longjaw mudsucker and lined shore crab) that were measured by colleagues of the Pacific Estuarine Ecosystem Indicator Research (PEEIR) consortium were integrated together for an expanded multiple lines of evidence approach. Previous studies have shown that toxicity potential of sedimentary contaminants, based on mean probable effects level quotients (mPELQs), was highest in Stege Marsh in San Francisco Bay and lowest in reference marshes in Tomales Bay. Sea urchin (*Arbacia punctulata*) porewater toxicity tests showed a significant decrease in fertilization in 7 of 13 samples from San Francisco Bay. Toxicity identification evaluation (TIE) tests with pore water revealed that organic contaminants that were not measured in the present study were likely responsible for the observed fertilization reduction. Benthic macroinvertebrate survey showed an alteration in their community structure. Significantly declined species diversity and richness and a significantly higher contribution of oligochaetes were found in Stege Marsh. The results of the present study indicate that sediments in Stege Marsh are highly degraded by contaminants and do not fully support a healthy benthic community.

Key Words - *Sediment quality assessment; mean PELQs; Porewater toxicity; Elutriate toxicity; Benthic macroinvertebrate community; Sublethal toxicity*

Theme: Contaminants

Poster Board Number: 145. Submission Number: 334

Our Actions, Our Estuary
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POSTER ABSTRACTS

Delta RMP: Developing the Delta Regional Monitoring Program for Contaminants

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A diverse array of agencies and other entities monitor water quality, flows, and ecological conditions in the Delta. However, under the current monitoring framework, our ability to develop an integrated assessment of water quality in the Delta is limited by a number of factors, including variability in the level of assessment, reporting, and access to the data among these programs. In addition, there is a general recognition that significant data gaps exist, notably with respect to contaminants. The State Water Board and Central Valley Regional Water Board have initiated an effort to develop a Delta Regional Monitoring Program (Delta RMP) using a collaborative stakeholder process in coordination with similar efforts in the Bay-Delta and upstream tributaries. Development of a comprehensive monitoring program for the Delta was identified as a priority action in the Strategic Workplan for Activities in the San Francisco Bay/Sacramento-San Joaquin Delta Estuary, which was adopted by the State Water Board, Central Valley Regional Water Board, and San Francisco Bay Regional Water Board (collectively Water Boards) in 2008. Development of the Delta RMP is expected to proceed in a phased approach. The first phase of the program development (pilot phase) will focus on three objectives: 1. Develop capabilities for regularly compiling, synthesizing, and reporting data from existing, ongoing monitoring efforts; 2. Build interest, involvement, and momentum by answering important questions that require a comprehensive, regional view; and 3. Use this effort as a proof of concept that sets the stage and creates capabilities and recommended approaches needed for an integrated, coordinated RMP that is capable of informing environmental management program and policy decisions. Phase II will have the purpose of defining the long-term structure and goals of the Delta RMP. We expect that the long-term program will strive for integration across different programs based on the results of the pilot phase.

Key Words - *regional monitoring; program development; Sacramento-San Joaquin Delta*

Theme: Contaminants

Poster Board Number: 146. **Submission Number:** 171

POSTER ABSTRACTS

Assessment of Endocrine Disruption in Splittail (*Pogonichthys macrolepidotus*) in the Lower Sacramento-San Joaquin River Drainage

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In recent years, there has been increasing concern regarding the role of environmental contaminants in the decline of several fish species in the Sacramento/San Joaquin River Delta, California. To assess potential endocrine disruption in the Sacramento splittail (*Pogonichthys macrolepidotus*), a native fish of the Delta, we measured vitellogenin (Vtg) in blood and developed sample site contaminant profiles by deploying semi-permeable membrane devices (SPMD) and Polar Organic Chemical Integrative Samplers (POCIS). Sampling sites were located in Suisun Marsh. We found two male splittail out of 12 had extremely elevated levels of Vtg. Legacy organochlorines were detected at varying levels which included DDT, DDE and dieldrin at 67.2 ppb, 429 ppb and 390 ppb, respectively. In addition to the organochlorines, elevated levels of the organophosphate pesticide chlopyrifos and dioxathion at levels ranging from 745 to 71.5 ppb. Pyrethroids were also detected. Bifenthrin, cypermethrin and fenprothrin were detected at levels between 12.7 to 1.45 ppb. Triazine herbicides such as atrazine, troton, prometon and simetryn were also observed varying between 74.0 to 27.2 ppb. Of greatest concern is data from the northern region of the Delta, an area heavily used by delta smelt for spawning, where samples contained chlopyrifos concentrations in excess of 100 ppb.

Key Words - *endocrine disruption, pesticides, splittail*

Theme: Contaminants

Poster Board Number: 139. **Submission Number:** 246

POSTER ABSTRACTS

Evaluation of Estrogenic Activity and Chemical Contamination in Surface Waters of the Sacramento River Delta, CA USA

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Over the past 8 years, abundance indices of several pelagic fish species residing in the Sacramento-San Joaquin Delta of California, USA, have shown marked declines and record lows. In order to evaluate the contribution of endocrine alterations in resident fish, water samples were evaluated for estrogenic activity, using a rainbow trout liver hepatocyte assay for vitellogenin transcription and an in vivo Japanese medaka exposure assay for vitellogenin protein. In addition, a series of analytes were measured including estrogen steroids, alkylphenols and alkylphenol ethoxylates. None of the sites had in vitro estrogenic activity above the detection limit of 0.02 ng/L estradiol equivalents (EEQ). However, in vivo activity was observed in two sites (711, lower Sacramento River, and 405, Carquinez Strait near Benicia) ranging from 13-26 ng/L EEQ. Concentrations of 17 β -estradiol, estriol and estrone were below quantification limits (0.1 ng/L), but measurable alkylphenols and ethoxylates were observed at combined concentrations less than 1 μ g/L at site 711 (below known effects thresholds for both assays). Additional analytical evaluation of 31 pesticides and enantiomers at site 711 only indicated the occurrence of bifenthrin (~1 ng/L) and diuron (41-86 ng/L). These results indicate in vivo estrogenic activity, which was not associated with concentrations of steroid estrogens, but mixtures of alkylphenols, alkylphenol ethoxylates and pesticides as contributing agents cannot be ruled out.

Key Words - *endocrine disrupters, estrogens, hormones*

Theme: Contaminants

Poster Board Number: 141. **Submission Number:** 204

Our Actions, Our Estuary
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POSTER ABSTRACTS

Growth performances and tissue burdens of juvenile green sturgeon (*Acipenser medirostris*) fed graded levels of methyl mercury chloride.

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San Francisco Bay Delta has a long history of mercury (Hg) contaminations. However, there are very limited studies on the toxic effects of Hg in its native fish, especially predatory species that bioaccumulate Hg through the food chains. Triplicate groups of juvenile green sturgeon (30 g ± 2) each were exposed to four levels of dietary methylmercury chloride (MeHg; 0, 20, 40, 80 mg Hg/kg diet) for 8 weeks to determine the effect on growth performances and tissue burdens of Hg in the sturgeon. Mortality, growth rate, feed efficiency, condition factor, hepato-somatic and gonado-somatic indices, body proximate composition, and Hg tissue (gill, heart, liver, kidney, gonad, white muscle) burden were determined. Significantly (P<0.05) increased mortality were observed in the highest dose group after week 6 and significantly decreased growth rate was observed in the highest dose group after week 2. Feed efficiency showed significant decreases in the highest dose group at or after week 2. Dietary Hg accumulated in a dose-dependent manner in all tissues; the highest Hg tissue concentrations were found in the kidney and the lowest in the gonad. In conclusion, dietary Hg at or above 40 mg Hg/kg significantly affected mortality, growth rate, and feed efficiency. Dietary Hg concentrations at or above 20 mg Hg/kg significantly elevated tissue Hg concentrations.

Key Words - *Mercury; sturgeon; growth performances*

Theme: Contaminants

Poster Board Number: 128. **Submission Number:** 234

Our Actions, Our Estuary
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POSTER ABSTRACTS

Guadalupe River Watershed Model: Support tool for regional Hg and PCB management

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San Francisco Bay is listed as impaired for mercury (Hg) and PCBs, and the associated TMDLs call for improved regional loads estimates and greater than 50% load reductions from urbanized small tributaries in general and over 90% load reduction in the Guadalupe River watershed over the next 20 years. In order to address this call, managers need improved information on which BMPs may be effective and what magnitude of application will be needed to see measurable loads reductions at the watershed and regional scales. To inform the management questions, the Regional Monitoring Program for Water Quality in San Francisco Estuary funded a pilot study to develop a dynamic watershed model of the Guadalupe River Watershed. This watershed offers a unique opportunity to study legacy Hg from the largest-producing former Hg mine in North America as well as legacy PCBs from the manufacturing industries of the 1950s and 1960s. An abundance of local water, sediment, and contaminant data make the Guadalupe River Watershed an ideal study area.

The objective of the Guadalupe Watershed Model project is to understand the source, release, and transport of sediment and contaminants from a large mixed land-use, highly urbanized watershed. The first phase of the project was to develop the underlying hydrological model in the EPA's watershed modeling software suite BASINS/HSPF. A reasonably accurate model (within 20% of annual flow volumes) was developed despite challenges due to the high degree of watershed hydromodification including numerous reservoirs and percolation ponds. The second phase, currently underway, is to add sediment, Hg and PCBs into the model. The final model will serve to improve the accuracy of Hg and PCB load calculations, to investigate inter-annual load variability due to climate, and to allow scenario testing for optimizing management practices.

Key Words - *mercury; PCBs; watershed model; BMP*

Theme: Contaminants

Poster Board Number: 132. **Submission Number:** 150

Our Actions, Our Estuary
9th Biennial State of the San Francisco Estuary Conference
POSTER ABSTRACTS

Field Collection and Stabilization of Reactive Mercury in Natural Waters

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Reactive mercury [Hg(II)_R] is a term used to encompass a variety of inorganic mercury complexes. It is referred to as Hg(II)_R due to its high probability of either undergoing biotic methylation to create methylmercury or becoming bound to other substances such as particulates. Variability has been shown in Hg(II)_R in natural water samples, even within 24 hours of collection, limiting the ability of field personnel to transport samples to the lab without changes in Hg(II)_R concentrations. Hg(II)_R is an important mercury species to understand due to its relationship to methylmercury; however, to date there has been a lack of a robust, accurate, and precise method for measuring Hg(II)_R in aqueous samples.

The work presented here describes a new method developed for the field collection and stabilization of Hg(II)_R, thus avoiding any species shift that may occur after collection. In this method, the sample is chemically reduced and collected onto a gold trap in the field. The gold trap can then be sent to the laboratory for analysis. This field-sampling system is unique due to its utilization of the sample collection bottle as the purge vessel, greatly reducing the equipment needed in the field as well as potential routes of contamination. Additionally, this allows for anoxic samples to be collected and purged in the field without the use of a glove box, providing a simple method to prevent potential species shift caused by oxidation. By limiting the time from collection to volatilization, as well as creating a completely anoxic collection technique, the field-sampling system offers a simple way to get precise results for Hg(II)_R species in natural waters. Given the importance of Hg(II)_R in the study of mercury cycling in the environment and the difficulty of obtaining accurate *in situ* data, this field sampling technique offers a clear improvement in obtaining specific and definitive results.

Key Words - *reactive mercury, field collection, stabilization*

Theme: Contaminants

Poster Board Number: 130. **Submission Number:** 184

Our Actions, Our Estuary
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POSTER ABSTRACTS

Trophic transfer of methylmercury in a simple food chain

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In previous laboratory experiments assessing the influence of naturally occurring dissolved organic matter (DOM) from the San Francisco Bay Delta on methylmercury (MeHg) bioavailability, we found that phytoplankton accumulation of MeHg was inversely proportional to the DOM concentration over a natural range of DOM concentrations. The goal of this experiment was to determine if the differences in MeHg concentrations in phytoplankton would be passed on to amphipods (*Hyaella azteca*) consuming those phytoplankton. We exposed the diatom *Cyclotella meneghiniana* to MeHg for 24 hours in water with (10 mg/L) or without organic matter from Mandeville Tip in the Delta. Radiolabeled cells were then resuspended into unlabeled fresh water (to minimize potential for amphipods to take up MeHg from the dissolved phase). Amphipods were fed radiolabeled cells for 35 minutes and then fed unlabeled algae during depuration. We followed the depuration of MeHg from the amphipods for 96 hours. Amphipods feeding on phytoplankton from the high DOM treatments initially accumulated less MeHg than amphipods feeding on phytoplankton from the no DOM treatment. However, assimilation efficiencies of ingested MeHg in the amphipods were around 65-70% for both treatments and MeHg retention in amphipods was unaffected by DOM. The results suggest that DOM decreases the amount of MeHg that can be accumulated in aquatic food chains by influencing the amount taken up from water by phytoplankton but not by influencing the trophic transfer process itself.

Key Words - *mercury; methylmercury; bioaccumulation; dissolved organic matter; phytoplankton; amphipods*

Theme: Contaminants

Poster Board Number: 133. Submission Number: 161

Our Actions, Our Estuary
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POSTER ABSTRACTS

Transport and fate of ammonium supply from a major urban wastewater treatment facility in the Sacramento River, CA.

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Effluent from wastewater treatment plants (WWTP) represent a major source of anthropogenic nitrogen to coastal and estuarine waters. In the Sacramento River, ammonium (NH₄) loading from WWTP's has increased three-fold since the 1980's and represents 90% of the river's total NH₄ load. Despite the large WWTP influence on river nitrogen, little is known about how riverine phytoplankton may respond to nutrient enrichment or the potential consequences of elevated NH₄ downstream in the San Francisco Estuary and Delta. Recent studies in the northern San Francisco Estuary suggests that elevated NH₄ may contribute to the documented decline in estuarine primary production and phytoplankton standing stocks by limiting diatom growth. Working with the regional water quality control board, we evaluated the potential for perturbations in primary production as a result of wastewater discharge in the Sacramento River using data from long-term monitoring programs and focused experimental manipulations. Our goals were to characterize nutrients, primary production and phytoplankton standing stocks along a 75 km riverine transects near the sewage outfall and to assess the capacity of the Sacramento River phytoplankton to process NH₄, and reduce NH₄ loading to estuarine receiving waters. These results may be used to guide current wastewater permitting, test future loading scenarios, and provide the basis for assessing downstream impacts of changing wastewater practices.

Key Words - *Wastewater; NH₄; ammonium; phytoplankton; Sacramento River; Delta*

Theme: Contaminants

Poster Board Number: 144. **Submission Number:** 119

Our Actions, Our Estuary
9th Biennial State of the San Francisco Estuary Conference
POSTER ABSTRACTS

Effects of a Restored Freshwater Tidal Wetland Complex on Habitat for Imperiled Native Fish

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The recent collapse of pelagic fish populations in the Sacramento-San Joaquin delta has led to increased interest in habitat restoration. Successful tidal wetland restoration has occurred naturally in the northern delta at Liberty Island, where a levee breach inundated the island in 1998 and a highly productive tidal freshwater wetland has developed. Liberty Island and its surrounding sloughs, known as the Cache Slough Complex, are now considered key habitat for endangered native fish species. The Cache Slough Complex is a priority area for future habitat restoration efforts to protect and enhance native delta fishes. This study examines the hydrodynamic “footprint” of Liberty Island in the Cache Slough complex. Continuous monitoring of flow, temperature, turbidity, and salinity is coupled with quarterly sampling of biological resources over spring and neap tidal cycles. We report seasonal diel patterns in chlorophyll-a, zooplankton, and mysid abundance from Liberty Island and surrounding sloughs. Understanding the patterns of hydrodynamics and productivity is important to describe the habitat of pelagic fishes including delta smelt, and will help to identify and plan future restoration projects in the region.

Theme: Design & Monitoring Strategies for Habitat Restoration

Poster Board Number: 55. Submission Number: 185

Our Actions, Our Estuary
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POSTER ABSTRACTS

The influence of short-term flooding and draining on oxidation/reduction potential of San Francisco Bay tidal marsh sediment.

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The purpose of this study was to determine changes in oxidation/reduction potential (ORP) of San Francisco Bay tidal marsh sediment when subjected to a variety of short-term (minutes to days) flooding/draining regimes. Experiments were conducted using physical marsh samples placed within specially designed mesocosm chambers located at Don Edwards National Wildlife Refuge (NWR) in Fremont, California. A procedure was developed that enabled extraction and insertion into mesocosm chambers of the vegetated marsh samples that comprised almost completely intact sediment blocks and their associated biota from NWR marsh plain habitat. These sediment/biota samples were referred to as mesocosm experimental units or MEUs. Each mesocosm chamber was placed within an individual reservoir so that multiple tests could be performed simultaneously and independently. MEUs were instrumented with fixed (for the duration of each experiment) platinum probes that were densely spaced, replicated, and oriented to collect data at 5, 10, and 15 cm below the sediment block surface. Flooding involved the metered introduction into the mesocosm/reservoir of water (obtained from the same marsh system from which the MEUs were collected) so that the entire sediment surface was inundated. Draining involved controlled gravity outflow from the mesocosm/reservoir. MEUs were subjected to flood/drain test patterns that mimicked a wide variety of tidal conditions, including high marsh, middle marsh, and intertidal pond conditions as well as instantaneous flood/drain conditions. The results revealed relatively rapid and highly repeatable trends in changes of ORP both temporally and spatially (x, y and z axes). Relevant results from the mesocosm tests were comparable with in situ data from the collection site, indicating that the data from the experimental setup generally were representative of the natural environment. Implications of the results regarding tidal marsh processes that may be affected by sediment ORP variations will be discussed.

Key Words - *tidal marsh; ORP; mesocosms; sediment; flooding; draining*

Theme: Design & Monitoring Strategies for Habitat Restoration

Poster Board Number: 60. Submission Number: 154

Our Actions, Our Estuary
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POSTER ABSTRACTS

Hamilton Wetland Restoration Project

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The Hamilton Wetlands Restoration Project (HWRP) is one of the largest tidal wetland restoration projects in the U.S. involving the beneficial reuse of dredged sediment. The Project is a coordinated effort by stakeholders including and not limited to Federal/State/local agencies, environmental interest groups, commercial navigation groups, and local residents beginning in the 1980's.

The project design approach is to create a constructed template from which natural processes will complete restoration of natural wetland function. This project will restore tidal wetlands and other habitats on areas that were tidal wetlands until the early 1900's and were converted into non-tidal farm land and military uses by diking and draining. Lessons from monitoring of reference sites including Sonoma Baylands and Rush Creek are being incorporated into the site design.

This poster will describe the construction approach to creating and restoring a mosaic of about 2,600 acres of tidal wetlands, seasonal wetlands, and associated upland buffer habitats at the HWRP with up to approximately 25 million cubic yards of dredged sediments from navigation projects within the San Francisco Bay Region. To date the project has placed more than 3 million cubic yards of sediment on the Hamilton Airfield and the State Lands Commission parcels. The Hamilton Airfield site is finished with most of the site preparation and is approximately mid way through sediment placement.

This presentation will review the lessons learned and challenges involved in constructing large wetlands areas by beneficial reuse of dredged sediments in an area adjacent to homes and businesses and in coordination with on-going military cleanup operations within the site. The presentation will also describe the next steps towards completing project design and construction including the potential involvement of community groups to assist with vegetation planting.

Theme: Design & Monitoring Strategies for Habitat Restoration

Poster Board Number: 57. Submission Number: 146

Our Actions, Our Estuary
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POSTER ABSTRACTS

Salt marsh vegetation pattern relationship to soil conditions and possible plant-soil feedback

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The successful restoration of some salt marsh sites may depend on the potential for multiple plant species to engineer the developing system via unique physio-chemical mechanisms. Salt marsh plant species exhibit diverse adaptations to the intertidal, particularly in their physiological regulation of water and salt uptake from the soil. A species' water and salt use may also affect surrounding soil conditions, potentially creating a positive ecosystem engineering feedback loop. Geophysical mapping of the soil electrical conductivity of a high-elevation, relatively pristine salt marsh permitted analysis of spatially-variable plant-soil relations in unprecedented detail (2-meter resolution). Geophysical surveys conducted during dry and wet soil conditions revealed similar soil conditions among marsh regions dominated by different plant species. Typical metrics of vegetation zonation such as elevation and distance-to-channel also failed to explain the plant distribution. We developed a new geophysical method to calculate soil saturation and salinity changes between dry and wet marsh conditions. Statistical analysis showed that the spatial pattern of changes in soil saturation and salinity between dry and wet tidal conditions was the most effective predictor of the vegetation pattern at the field site. We attribute this soil dynamics-related habitat differentiation to possible ecosystem engineering mechanisms that we hypothesize based on our data and the known salinity tolerances, competitive abilities, and physiological adaptations of each species. The geophysical methods employed in this study may provide an effective and inexpensive means to monitor the development of marsh-appropriate soil conditions and perhaps, with further study, to forecast corresponding marsh re-vegetation patterns.

Key Words - *salt marsh; vegetation zonation; soil conditions; geophysics; restoration*

Theme: Design & Monitoring Strategies for Habitat Restoration

Poster Board Number: 54. Submission Number: 115

Our Actions, Our Estuary
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POSTER ABSTRACTS

Coastal Habitat Restoration in San Francisco Bay

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Coastal wetlands support a unique community of marsh species and provide many important ecological services such as water filtration, flood control, and carbon sequestration. In San Francisco Bay, these wetlands support large numbers of wintering and migrating shorebirds, and have therefore been designated an Important Bird Area of global significance. Despite the huge loss of tidal wetlands in San Francisco Bay over the last century, the wetlands that remain account for 90% of California's remaining tidal wetlands, underscoring the importance of tidal wetland conservation and restoration. Audubon California is currently engaged in collaborative projects in San Pablo Bay and Richardson Bay with the goal of conserving, restoring, and enhancing coastal wetlands. In San Pablo Bay, a history of diking and ditching has led to depressions that hold water for long periods following spring tides and storms. This ponding leads to high mosquito production rates requiring pesticide treatment and to reduced vigor of marsh vegetation, both of which lead to degraded habitat for the federally endangered salt marsh harvest mouse and California Clapper Rail, the California threatened Black Rail, and other species. By improving drainage channels, this project will provide additional habitat for birds, enhance salt marsh vegetation for small mammals, and reduce the need for pesticide application. In Richardson Bay, we are working on a plan to rehabilitate an island that was created from dredge and upland fill soils in the 1960s that is now suffering from erosion and nonnative plant invasion. This project seeks to replace the retreating shoreline with gradually sloping sand and gravel beach that will provide roosting habitat for terns and shorebirds and potentially facilitate re-use of the island as harbor seal haulout. We also seek to rehabilitate existing tidal marsh and grassland habitats to improve wildlife habitat for shorebirds, waterfowl, and special-status native plants.

Key Words - *salt marsh restoration; shorebirds; coastal wetlands*

Theme: Design & Monitoring Strategies for Habitat Restoration

Poster Board Number: 61. Submission Number: 196

Our Actions, Our Estuary
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POSTER ABSTRACTS

Improving Water Quality Within Tomales Bay Through Large-Scale Restoration

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Wetlands are believed to play an important role in improving water quality, which is a crucial function for estuaries such as Tomales Bay. While Tomales Bay is viewed as pristine, its waters have been impacted by leaking septic tanks, agriculture, and mercury and are designated by the state as impaired under Section 303(d). These problems have galvanized efforts to improve water quality through both source reduction and restoration. The 550-acre Giacomini Wetland Restoration Project could have tremendous benefits for water quality by restoring a historic marsh diked for operation of a dairy ranch. Two-thirds of the Bay's freshwater input -- the principal contaminant source -- comes from tributaries upstream of the Giacomini Ranch. In 2007-2008, the National Park Service restored hydrologic connectivity to the Giacomini Ranch by removing levees, tidegates, and culverts; realigning leveed creeks; filling drainage ditches; and constructing new tidal channels. Unlike many diked areas in San Francisco Bay, the ranch had not subsided substantially since being diked (<1-3 feet), which not only speeds up the restoration timeline in terms of improving functionality, but provides some resiliency in the face of anticipated sea level rise. To determine success of restoration in improving water quality, the Park Service developed an innovative long-term monitoring program to assess water quality in the Project Area and reference wetlands before and after restoration. Computer modeling results had suggested that as much of 20 percent of the floodwaters from Lagunitas Creek could flow through the restored wetlands during 2-year storm events, leading to substantial reductions in pollutant inflow to Tomales Bay. Following restoration, pollutant concentrations have already decreased within the former dairy, which had the highest pre-restoration pollutant concentrations. However, the lack of large storm events during 2008-2009 may have reduced the newly restored marsh's effectiveness in reducing downstream pollutant loading.

Key Words - *restoration; water quality; habitat improvement; monitoring*

Theme: Design & Monitoring Strategies for Habitat Restoration

Poster Board Number: 59. Submission Number: 156

Our Actions, Our Estuary
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POSTER ABSTRACTS

Designing Seasonal Wetland Creation and Upland Habitat Enhancement on a Former Municipal Landfill, Berkeley Meadow, Berkeley, California

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LFR Inc. (LFR) designed three phases of the Berkeley Meadow 70-acre seasonal wetland creation and upland habitat enhancement program with the East Bay Regional Park District (EBRPD) at Eastshore State Park. Final design and construction for Phase I was completed in 2005, Phase II was completed in 2008 and Phase III is currently under construction. For Phases I and II agreements were facilitated between EBRPD and private interests under the EBRPD's Resource Enhancement Program allowing mitigation and endowments for long-term maintenance; Phase III was sponsored by the California Coastal Conservancy. The projects are supported by stakeholders including Sierra Club, Audubon Society, Citizens for Eastshore State Park, and Save the Bay. Existing condition characterization, hydrology studies, grading/planting plans were developed using updated topographic and vegetation survey data. Habitat mitigation plans, construction drawings/specifications and technical studies provided the foundation for final engineered wetland basins, soil cover criteria, native planting/seeding, and construction of 2,200+ linear feet of stabilized earthen trail, observation areas, fences, and gates. A wetland soil moisture balance was utilized to determine potential wetland creation area and avoid impacts to existing wetlands. Monthly water balance computations coupled with evaluation of direct surface runoff contributions supported development of the final design. Mass balance techniques and water levels were used to assess soil saturation, surface ponding potential and projected flows through interconnected wetland cells. Created wetland ponding and/or soil saturation was projected to extend from January through March for an average rainfall year (confirmed for Phase I). Lessons learned from previous phases helped refine Phase III plans/specifications allowing for seasonal/salt panne wetland creation while minimizing excavation and maximizing soil cover. Phase III also includes: habitat enhancement strategies for special-status bird species (white shouldered kite and northern harrier); updates to the plant/seed palette; control of invasive non-native vegetation; earthwork contingency planning; and pre-construction biological surveys.

Key Words - *seasonal wetland; water balance; soil criteria; mitigation; engineering*

Theme: Design & Monitoring Strategies for Habitat Restoration

Poster Board Number: 62. Submission Number: 121

Our Actions, Our Estuary
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POSTER ABSTRACTS

Outer Bair Island Tidal Restoration

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The tides were recently restored to Outer Bair Island. This was the first completed component of a larger restoration project aimed at restoring 1,400 acres of the entire 2,600-acre Bair Island complex. Historically, the island complex (Inner, Middle, and Outer Bair Islands) was part of a large expanse of tidal wetlands that extended along the southeastern edge of San Francisco Bay. The island complex was diked for agriculture in the late 1800's. In 1946 the area was converted to salt production, which continued until 1965, though the legacy of wetland conversion remains. The goal of this 468-acre project was to restore a more natural tidal hydrologic regime and salt marsh habitat on Outer Bair Island. To complete the restoration, several specific construction activities were required. First, the perimeter levee was breached in two locations to restore tidal exchange between Steinberger Slough and remnant tidal sloughs within the island. Second, a pilot channel was excavated through the accreted perimeter marsh at the eastern breach. Third, the internal borrow ditch created when the perimeter levee was initially constructed was blocked with earthen ditch blocks on each side of the large breach in order to direct tidal flow into historic slough channels. Two additional ditch blocks were placed further south, adjacent to Corkscrew Slough to facilitate flow in the historic channels in anticipation of future breaches as part of the Middle Bair Restoration. Implementation of the Outer Bair Island project began the long process of restoring some of the historic wetland functions and values to this unique area. Our presentation will highlight design elements, construction completion, and subsequent monitoring data. This project will have myriad benefits for people and wildlife once sediments accrete and tidal marsh vegetation begins to colonize.

Key Words - *tidal restoration; salt marsh; salt pond*

Theme: Design & Monitoring Strategies for Habitat Restoration

Poster Board Number: 58. Submission Number: 228

Our Actions, Our Estuary
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POSTER ABSTRACTS

Beneficial Reuse of Dredged Sediment in Wetland Restoration

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Large scale restoration is taking place in San Francisco Bay and the Delta. The region's 13 largest permitted projects will result in nearly 40,000 acres of new wetlands. Among these major projects (all of which are diked former baylands) are the South Bay Salt Pond Restoration Project, the Montezuma Wetlands Project, the Hamilton/Bel Marin Keys Wetland Restoration Project, and several Napa-Sonoma and Delta projects. Increasing concerns about sea level highlight the vulnerability of levee-dependent habitats and the critical role of wetlands for flood control. Given the likelihood of accelerated sea level rise, the question arises as to whether or not the supply of sediment will be adequate to sustain the marshes after restoration. Strategic beneficial reuse of dredged sediment could be key to achieving the region's restoration goals. The CCMP, Ecosystem Habitat Goals report and the LTMS strategy planning documents all call for beneficial reuse of sediment. The most prominent examples of sediment reuse in construction are Montezuma Wetlands and Hamilton Wetlands whose designs incorporate large amounts of reused sediment. These will use 17 million cubic yards and 24.4 million cubic yards respectively. This poster discusses the role of sediment reuse in restoration around the Bay and Delta and will highlight unique habitats being created by the Montezuma Project. Montezuma is the only Bay/Delta project that accommodates beneficial reuse of non-cover sediment for wetlands restoration. It is also unique in that it is the largest single project in the Delta and has the potential to establish more brackish wetland habitat than any of the other large projects mentioned above, thus providing critical habitat for the endangered Delta smelt and threatened longfin smelt. Montezuma project designers are using adaptive management to plan for the inclusion of California least tern habitat at the site in response to observed nesting over three breeding seasons. Although not part of the original plan, managers have now included habitat for this species in the restoration plan. This paper will illustrate the importance of sediment supply from beneficial reuse to restoration activities in the estuary.

Key Words - *wetlands; restoration; sediment; beneficial reuse; tern*

Theme: Design & Monitoring Strategies for Habitat Restoration

Poster Board Number: 56. **Submission Number:** 258

POSTER ABSTRACTS

The impacts of riparian tree removal on water shading in the Sacramento-San Joaquin River Delta using Lidar data analysis

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The presence of trees may be destabilizing the levees along the Sacramento-San Joaquin River Delta, and the removal of levee trees is a possible scenario undergoing discussion to strengthen the levees. One unintended consequence of tree removal may be a significant decrease in riparian shading, which can lead to a subsequent increase in water temperature. Increased water temperature can lead to changes in fish habitat, behavior, and overall health, shifts in species, changes in metabolic and decomposition rates, and different water chemistry. We modeled the relative change in incident solar radiation on channels in the Sacramento-San Joaquin River Delta under the current conditions and under a hypothesized treeless Delta. We used classified, 1m Lidar data of the Delta, acquired by the Airborne 1 Corporation during late January to February 2007, as the base dataset to examine both of these scenarios. The first return dataset provided the current structural conditions, and the bare earth layer provided the treeless scenario. We ran a solar irradiation model (r.sun) to calculate daily irradiation for summer months on a per-pixel (1m) basis. r.sun calculates daily irradiation using both slope/aspect information as well as occlusion by adjacent objects via a ray-tracing algorithm. Our results estimate as much as a 10% increase in solar radiation across the Delta should the trees be removed, a change that may result in significant increases in water temperature and changes in critical habitat.

Key Words - *lidar; riparian shading; remote sensing; water temperature; radiation*

Theme: Ecosystem Management-Remote Sensing Cluster

Poster Board Number: 16. **Submission Number:** 227

Our Actions, Our Estuary
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POSTER ABSTRACTS

Applications of airborne remote sensing in the Sacramento-San Joaquin River Delta

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Comprehensive monitoring of the Sacramento-San Joaquin River Delta is a critical component of ecosystem management and decision support. Monitoring is greatly facilitated by remote sensing technologies that provide synoptic data acquired rapidly across large areas. Airborne remote sensing missions can be flown on-demand to maximize monitoring outcomes. Hyperspectral imaging and light detection and ranging (LiDAR) are readily available, state-of-the-science airborne remote sensing technologies that have provided extensive datasets of the Delta, and have been used successfully in a number of management applications. Hyperspectral imagery has been used to create maps of aquatic vegetation distribution. These maps have been used to monitor the result of large-scale herbicide application to exotic Brazilian waterweed, and to study community composition changes in floating aquatic vegetation subsequent to successful control of exotic water hyacinth. The maps were also used to understand the hydrodynamic controls on submerged plant presence. LiDAR data has been used to identify individual tree crown sizes on every levee of the Delta, many of which are currently being considered for removal to meet federal levee standards. LiDAR first and last returns were used to model levee tree removal and the consequent increase in solar radiation incident on Delta waterways.

Key Words - *Remote sensing; management; hyperspectral; LiDAR*

Theme: Ecosystem Management-Remote Sensing Cluster

Poster Board Number: 12. Submission Number: 191

Our Actions, Our Estuary
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POSTER ABSTRACTS

Using remote-sensing products to identify velocity thresholds on submerged aquatic vegetation cover in the Sacramento-San Joaquin Delta

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In the Sacramento-San Joaquin River Delta, submerged aquatic vegetation (SAV) alters river hydrodynamics, affecting the transport and fate of sediments, nutrients, and even other vegetation. Establishment and persistence of submerged plants are, in theory, limited by water velocity. Identifying the threshold at which velocities impact submerged plant cover is a critical component in parameterizing spatially distributed models of submerged plant cover and identifying potential niche space. There are velocity thresholds critical to plant cover identified in the literature, however, most are determined experimentally in hydraulic flumes, vary widely depending on methodology, and likely difficult to scale up to the ecosystem level, natural environment. Here, we used submerged aquatic vegetation distribution maps derived from airborne hyperspectral imagery to extract submerged plant cover in a 1 km buffer around velocity monitoring stations deployed throughout the Delta. Since water velocity constrains, but does not necessarily promote, establishment and persistence, we developed and applied an algorithm in which we iterated through different velocity thresholds, performing a t-test at each velocity to determine the significance of the separation in SAV cover above and below each threshold. The velocity position which yielded the most significant separation, then, was determined to be the velocity threshold on SAV establishment and persistence, and the p-value was the significance of this threshold. This analysis resulted in the detection of a significant velocity threshold, the position of which can be used to parameterize spatially distributed models of submerged aquatic plant cover.

Key Words - *Remote sensing; SAV; water velocity*

Theme: Ecosystem Management-Remote Sensing Cluster

Poster Board Number: 13. Submission Number: 131

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POSTER ABSTRACTS

Object based tree crown detection and size prediction with LIDAR imagery

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With current concerns over the affects of destabilization of levees in the San Joaquin-Sacramento Bay Delta due to tree root incursion, we performed an assessment of the size and distribution of trees using tree crown detection algorithms applied to LIDAR data collected across the entirety of the legal Delta. Using local maximum heights as seeds, we applied a region growing algorithm to the LIDAR imagery to derive candidate tree crowns. We assumed that tree crowns would decrease in height from the peak to the edge. False positives were removed using object based techniques such as shape, size, and spectral characteristics of the tree crowns. Using these techniques, we were able to calculate the crown area and number of individuals trees along levees In the Delta.

Key Words - *remote sensing; lidar; trees*

Theme: Ecosystem Management-Remote Sensing Cluster

Poster Board Number: 15. Submission Number: 226

POSTER ABSTRACTS

Preliminary results from change detection of floating aquatic species in the Sacramento-San Joaquin Delta

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The Sacramento-San Joaquin Delta is one of the most heavily invaded estuaries in the United States. Water hyacinth is a major invasive plant species colonizing the Delta that has, along with other invasive species, negatively impacted the health and hampered the recreational and commercial uses of the estuarine ecosystem. Hyperspectral HyMap imagery at 3 m resolution was acquired over the Delta from 2004 to 2008 and classified into six main target classes: water, submerged aquatic plants, water hyacinth (*Eichornia crassipes*), pennywort (*Hydrocotyle umbellata*), water primrose (*Ludwigia* spp.) and 'other' which included soil, dry vegetation, emergent and riparian plants. Post-classification change detection analysis of the five images was done at 30 m spatial resolution particularly looking at declining and growing regions of water hyacinth. The results of this study highlight the biotic and abiotic characteristics of these regions. This study also concludes that areas cleared of water hyacinth through management are most frequently colonized by submerged vegetation. On the other hand, areas with submerged vegetation are the most likely to be invaded by water hyacinth. Further investigation of these patterns should yield important information on the future of water hyacinth colonization.

Key Words - *invasive species; water hyacinth; change detection*

Theme: Ecosystem Management-Remote Sensing Cluster

Poster Board Number: 17. Submission Number: 132

Our Actions, Our Estuary
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POSTER ABSTRACTS

Use of hyperspectral remote sensing to evaluate efficacy of aquatic plant management

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Invasive aquatic plant species negatively affect biodiversity, fluvial dynamics, water quality, and water storage. In California's Sacramento-San Joaquin River Delta, one submersed species – *Egeria densa* – and one floating species – *Eichhornia crassipes* – are actively managed to maintain navigable waterways. We monitored the spatial and temporal dynamics of these species and their communities using airborne hyperspectral data and assessed the effect of herbicide treatments used to manage these species from 2003 to 2007. Each year in the early summer, 12% of the surface area of the Delta was occupied by submersed aquatic plant species and 2-3% by floating invasive plant species. Since 2003, the coverage of submersed aquatic plant species expanded about 500 ha, whereas the coverage of *E. crassipes* was reduced. Although local treatments have reduced the coverage of submersed aquatic plants, Delta-wide cover has not been significantly reduced. In contrast, the spread of water hyacinth either has been constant or decreased over time. These results show that (1) the objectives of the *Egeria densa* Control Program (EDCP) have been hindered until 2007 by restrictions imposed on timing of herbicide applications, (2) repeated herbicide treatment of water hyacinth has resulted in the control of the spread of this species, which also seems to have facilitated the spread of water primrose and pennywort. These results suggest that management of the Delta aquatic macrophytes may benefit by an ecosystem-level implementation of an Integrated Delta Vegetation Management and Monitoring Program, rather than targeting only two problematic species.

Key Words - *Remote sensing; management; hyperspectral; egeria; water hyacinth*

Theme: Ecosystem Management-Remote Sensing Cluster

Poster Board Number: 14. Submission Number: 212

POSTER ABSTRACTS

Calculation of 100-Year Still Water Level and Wave Runup for Levee Design at Oakland International Airport, California

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In order to maintain their accreditation in the National Flood Insurance Program, the levees protecting Oakland International Airport (OAK) were evaluated for their ability to protect the airport from 100-year flooding due to tides, storm surge, and waves in San Francisco Bay. Historical tidal data, hydrodynamic and wave modeling, and empirical relations were used to determine the levee height and armor type necessary for this level of protection. To determine what level of protection is necessary at OAK, coastal conditions had to be evaluated for the 100-year (1% annual chance) still water level (SWL), total water level (TWL), and erosive power. Total water level is equal to the sum of SWL (including both tidal stage and storm surge) and wave runup. Since OAK is located well within shallow San Francisco Bay, ocean swell and tsunami are not items of concern (Borrero et al, 2006). Due to limited computational resources and the limited correlation between observed still water level (including storm surge) and wind velocity, a ranking method was developed to determine which SWL and wind events generated the largest annual total water levels, which were then determined accurately via a two-dimensional wave model.

Key Words - *waves; levees; flooding*

Theme: Flood Control

Poster Board Number: 104. **Submission Number:** 181

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POSTER ABSTRACTS

A Sediment Budget for Two Reaches of Alameda Creek: support for flood control channel management

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Sediment deposition in flood control channels is a chronic problem for managers tasked with dual objectives to maintain both flood protection and aquatic or riparian habitat. Alameda County Flood Control and Water Conservation District (the District) has periodically dredged sediment from lower Alameda Creek to maintain channel flood capacity. Because dredging is costly and disrupts habitat, and because obtaining permits is becoming more difficult, the District is seeking to minimize dredging frequency. Conceptually this is achieved by reducing sediment supply from upstream, or modifying the channel for more efficient sediment transport. To potentially address upstream sediment supply, we evaluated two reaches identified by others as probable sources of sediment to the flood control channel: a highly incised reach of Arroyo De La Laguna and upper Alameda Creek in Sunol Valley. We developed a sediment budget for these reaches to identify the dominant processes and quantify rates of sediment supply and storage over time (1901 to 2006 over four decadal time periods). The budget was constructed from field and air photo bank erosion surveys, current and historical bed elevation surveys, tree coring to estimate floodplain age, and interpretation of USGS suspended sediment and bed load data. During the most recent period (1994-2006), roughly 6% of the sediment mass passing through the Niles gage was derived from net channel erosion, mostly from the Arroyo De La Laguna reach. While not the major source hypothesized by others, it remains substantial given the reach only comprises 0.25% of the watershed stream network length. Recommendations include identifying and quantifying potentially manageable sources of sediment throughout the watershed, enacting restoration approaches that encourage upstream sediment storage, and studying solutions to increase sediment transmission through the flood control channel. These efforts aim to reduce or eliminate downstream dredging requirements.

Key Words - *Alameda Creek; flood control channel; sediment budget*

Theme: Flood Control

Poster Board Number: 103. Submission Number: 138

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POSTER ABSTRACTS

U.S. Army Corps of Engineers Delta Initiatives

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The Delta covers about 738,000 acres interlaced with hundreds of miles of waterways. Much of the land is below sea level and relies on over 1,100 miles of levees for protection against flooding. In recognition of the socio-economic and environmental importance of the Delta and the serious threat of levee failure with disastrous and wide-spread consequences, Congress passed the CALFED Bay-Delta Authorization Act in 2004. This Act directed the U.S. Army Corps of Engineers (USACE) to undertake the construction and implementation of levee stability programs or projects for such purposes as flood control, ecosystem restoration, water supply, water conveyance and water quality. In May 2006, USACE submitted the CALFED Levee Stability Program (LSP) Report to Congress. One submission for consideration under the LSP was the proposed Bethel Island – Horseshoe Bend project. This project was chosen based on Bethel Island’s population and development, active funding participation by the Department of Water Resources (DWR), cooperation from resources agencies, and the opportunity for ecosystem restoration. Also in 2006, DILFS (Delta Islands and Levees Feasibility Study) was initiated by USACE with DWR to investigate flood damage reduction, ecosystem restoration, water supply, water quality, and recreation within the Delta. Whereas the LSP is generally considered to provide short-term actions within the Delta, DILFS considers a long term approach that would improve resistance to seismic events, and decrease erosion and seepage potential at islands determined critical to water quality, water supply, and protection of significant public infrastructure. The study is also considering setback levees, floodplain reconnection, restoration of wetlands and riparian habitats in the Delta. Once completed, this study would serve as a decision document that could provide USACE the authority in conjunction with other Federal, State, and local agencies, to address a wide range of water and related land resources problems throughout the Delta.

Key Words - *Delta; US Army Corps of Engineers; ecosystem restoration; flood damage reduction*

Theme: Flood Control

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POSTER ABSTRACTS

Historical Ecology Informing Restoration in East Contra Costa County

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The East Contra Costa County Habitat Conservancy and the Contra Costa Watershed Forum partnered with the San Francisco Estuary Institute to conduct an historical ecology assessment of natural resources in eastern Contra Costa County, CA. With limited money for restoration and conservation, concerned stakeholders want to use financial resources efficiently and effectively. A strong understanding of the historical distribution of habitats and their controlling factors provides a critical basis for understanding current conditions and the potential for future restoration. A large amount of data, both textual and graphic, has been collected and georeferenced. This data from the 1800s and early 1900s provide a wealth of information to describe the general historic status of habitat in the region as well as very parcel specific information on stream courses, plant diversity and other natural features. Though the Final Study will not be available until the end of 2009, the Conservancy is already using the interim products and datasets developed to inform habitat restoration design. A number of case studies will be presented demonstrating the application of this information in restoration. 1San Francisco Estuary Institute 2Contra Costa County and East Contra Costa County Habitat Conservancy

Key Words - *Historical Ecology; Habitat Conservation Plan; San Francisco Estuary Institute; East Contra Costa County Habitat Conservancy; Restoration; Contra Costa Watershed Forum; CA Coastal Conservancy; CCC Flood Control; Contra Costa County*

Theme: Habitat Restoration and Protection

Poster Board Number: 73. Submission Number: 231

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POSTER ABSTRACTS

Final Results of California's Wetland Demonstration Program Statewide Wetlands Assessment

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California's wetlands provide critical ecological services, even though the state has lost vast amounts of wetlands. It is imperative to protect what remains and to ensure that wetlands acreage being regained through restoration provide the desired ecological services. California has recently completed a survey of the extent and condition of coastal wetlands. This survey demonstrates how the state's Level 1-2-3 toolkit for assessing wetland resources can be used to determine where wetlands can be found and how they are doing. The 1-2-3 toolkit consists of standardized protocols for mapping (Level 1), low-cost assessment of the overall condition of wetland ecosystems via the California Rapid Assessment Method (CRAM) (Level 2), and standardized, intensive assessment protocols to quantify functions of wetlands (Level 3). We will present the survey's results for estuarine assessments (both ambient and project) and for riverine wetlands condition in the Napa watershed. 77% of the state's perennial estuarine wetlands can be found in the San Francisco estuary so focus will be on these regional results. State and regional survey results show landscape-level patterns related to anthropogenic. Overall condition decreases north to south. Threats that alter wetland hydrology, substrates, or biological communities include discharge of fill material, excavation, habitat fragmentation, and stressors such as invasive species, excess sediment, and contaminants. We will discuss the evaluation of the distributions, amounts, and shapes of estuarine wetlands and land use patterns. Clear landscape-level trends emerge. For instance, the survey found that 60% of the Bay's wetland margins are adjacent to developed land. This reinforces the link between wetlands and watersheds and the importance of our land use decisions. We will also present results of condition assessments. Regional CRAM results show consistently lower wetland physical structure scores for Bay Area than other regions. Ditching and invasive plants are more strongly correlated to wetland condition for Bay wetlands than for other regions of the state. The paper discusses the relative CRAM condition scores for wetland restoration projects and ambient survey results. Both statewide and regional project scores were lower than ambient scores. Such findings can be used to identify and prioritize appropriate, cost-effective management actions.

Key Words - *wetlands; restoration; monitoring; assessment, CRAM,*

Theme: Habitat Restoration and Protection; **Poster Board #:** 78. **Submission #:** 260

POSTER ABSTRACTS

Nutrient dynamics and production in San Francisco Bay eelgrass (*Zostera marina*) beds: food web and restoration implications.

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Seagrasses are important primary producers worldwide; seagrass beds harbor myriad species of primary producers, including algal epiphytes on their blades and benthic macroalgae. We conducted a survey of these three producer groups in San Francisco Bay eelgrass (*Zostera marina*) beds to support mesocosm experiments evaluating the interactions of these groups and their roles in trophic dynamics. We conducted quarterly surveys of four eelgrass beds, estimating biomass of eelgrass, epiphytes, and macroalgae. We found highly variable species composition and relative biomass of producers across these four eelgrass beds as well as large seasonal changes within beds. Both eelgrass and epiphyte biomass frequently varied 2 to 4-fold among sites. Macroalgal species composition was very different among sites, with a different dominant species contributing 1-2 orders of magnitude greater biomass than other algal species. We conclude that the total and relative contribution of biomass among producers varies dramatically across space and time in San Francisco Bay eelgrass beds, with implications for eelgrass health and food availability for higher trophic levels.

Key Words - *eelgrass; zostera marina; algae; san francisco bay*

Theme: Habitat Restoration and Protection

Poster Board Number: 71. **Submission Number:** 327

POSTER ABSTRACTS

The Lower Silver Creek Project, San José, California - From an Urban Flood Control Channel to a Naturally Functioning Urban Creek

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Lower Silver Creek has seen its hydrology progressively altered over the last 100 years by intense urbanization. In the summer of 2002, the Santa Clara Valley Water District started the construction of a 5-mile long flood control channel improvement project with the objective of providing 100-year flood protection while enhancing habitat value through the creation of a functional riparian and wetland system. To meet this objective, efforts were made to enhance in-stream and riparian ecosystem features while integrating principles of fluvial geomorphology into the project design. Design features included: 1) a vegetated multi-stage channel composed of an in-channel floodplain to dissipate high flow energy and facilitate the formation of a base flow channel by natural fluvial processes and, 2) a sediment transport channel sized to mobilize and transport sediment at an ecologically relevant frequency. The downstream reach of the project (approximately 2.5 miles) was completed in stages from November 2003 to November 2005. This presentation will present results of five years of monitoring riparian, wetlands and geomorphological features as well as address the major benefits, constraints, and limitations of integrating fluvial geomorphology concepts with urban stream flood control efforts.

Key Words - *restoration; flood control; monitoring*

Theme: Habitat Restoration and Protection

Poster Board Number: 66. Submission Number: 251

Our Actions, Our Estuary
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POSTER ABSTRACTS

Conceptual models for the Subtidal Goals Project

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The San Francisco Bay Subtidal Habitat Goals Project is a collaborative interagency effort that will establish a comprehensive and long-term management vision for protection, restoration, and appropriate use of the subtidal habitats of San Francisco Bay. The Project is a collaborative interagency effort among the Bay Conservation and Development Commission (BCDC), California Ocean Protection Council/State Coastal Conservancy, National Oceanic and Atmospheric Administration (NOAA), and San Francisco Estuary Project. The Subtidal Habitat Goals Project has recently developed conceptual models of various subtidal habitats, using color conceptual diagrams to illustrate key concepts in a visually intuitive way. The purpose of these models is to collect in one place the current understanding of these systems, and to provide some guidance to the development of goals. We present three examples of the current versions of these models. 1) A very general overall model emphasizes the decisions process concerning each of the habitat types: for example, which of the habitats are understood well enough to support actions and, of these habitats, which should be enhanced or protected? 2) The eelgrass model emphasizes the potential ecological roles of eelgrass beds and the opportunities for restoration or establishment of new beds. This model is the best supported by available information. 3) A model of hard substrates contrasts the function of hard-bottom areas in providing physical habitat with their potentially negative roles in supporting introduced species or introducing contaminants into the environment. Because other considerations go into the setting of habitat goals, the conceptual models alone are insufficient for this purpose. Nevertheless, the models provide a useful summary of the state of our understanding relevant to setting goals.

Key Words - *subtidal; restoration; conceptual diagrams*

Theme: Habitat Restoration and Protection

Poster Board Number: 72. Submission Number: 103

Our Actions, Our Estuary
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POSTER ABSTRACTS

Greening the Bay: the SF Bay Restoration Authority

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In 1999, the San Francisco Bay Area scientific community published the *Baylands Ecosystem Habitat Goals*, a consensus blueprint detailing the restored habitat needed to make the Bay healthy and sustainable. A central recommendation of this report is to attain at least 100,000 acres of tidal wetlands.

Using the *Habitat Goals*, together we have made significant progress toward protecting this vital natural and economic asset, and the ambitious 100,000 acre goal is actually in sight. The greatest obstacle is a lack of steady, reliable funding.

Save The Bay's report, "*Greening the Bay: Financing Wetland Restoration in San Francisco Bay*," presents our vision for a vibrant, healthy Bay ecosystem. This report documents the estimated cost to restore an additional 36,176 acres of shoreline property awaiting restoration to tidal wetlands. We highlight the challenges facing government agencies and advocacy organizations, and reveal the overwhelming public support for Bay restoration.

The 2008 creation of the SF Bay Restoration Authority, a new regional government agency charged with raising and allocating resources for the restoration of wetlands, implements the primary recommendation in "*Greening the Bay*." The Authority met for the first time on Earth Day 2009. The report recommends other specific policy initiatives to adequately fund the restoration of San Francisco Bay, aimed at increasing state and federal resources for wetland restoration.

Today we have the most significant opportunity to make San Francisco Bay healthier for wildlife and people since 1961, when Save The Bay was founded to stop the Bay from being filled in. Over the next several decades, we can secure a healthy future by restoring thousands of acres of thriving wetlands, reversing more than a century of degradation that reduced the size of our Bay by one-third.

Key Words - *Restoration; Tidal Marsh; Financing*

Theme: Habitat Restoration and Protection

Poster Board Number: 77. Submission Number: 99

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POSTER ABSTRACTS

Evaluating Habitat Restoration Success at the Scale of a River Reach: Rutherford Reach Restoration Monitoring, Napa River

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The Rutherford Reach Restoration project provides a unique opportunity for long-term monitoring of a 4.5 mile reach of the Napa River in response to a comprehensive treatment aimed at enhancing habitat value and reducing rates of fine sediment production on an incised North Coast alluvial channel draining to the San Francisco Bay estuary. The monitoring design provides for an annual rapid assessment of major changes along the thalweg and less frequent comprehensive geomorphic and habitat assessments at selected cross-section transects and longitudinal profile sub-reaches. The physical habitat assessment aims to capture potential increases in complexity due to the installation of instream structures, riparian revegetation, and potentially as a result of agricultural levee and land use setbacks. These results are integrated with ongoing fish surveys that document functional redds relative to pool-riffle distributions. With Phase 1 of the project breaking ground in summer 2009 and likely several years of implementation ahead, this monitoring framework promises adaptive management benefits in refining future phase designs and guiding long-term project maintenance.

Key Words - *Napa River; habitat restoration; monitoring; geomorphology; fish habitat*

Theme: Habitat Restoration and Protection

Poster Board Number: 65. **Submission Number:** 197

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POSTER ABSTRACTS

San Francisco Bay Joint Venture Active Wetland and Watershed Projects

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The goal of the San Francisco Bay Joint Venture (SFBJV) is to protect, restore, increase and enhance all types of wetlands, riparian habitats and associated uplands throughout the San Francisco Bay region to benefit birds, fish and other wildlife. The SFBJV helps identify potential partnerships and provide assistance needed to enhance the success of projects. SFBJV partners are undertaking a wide array of wetland, creek and associated projects throughout the region. This poster shows current active projects within the SFBJV boundaries that satisfy criteria laid out by the JV's Restoration Committee. Criteria for SFBJV "adoption" include projects that a) implement the recommendations of the Habitat Goals report and/or the JV Implementation Strategy, Restoring the Estuary; b) advance the goals of the JV by protecting, restoring, or enhancing habitat for target species including waterfowl, shorebirds, special status species, and anadromous fish; c) have a strong biological foundation; d) are implemented by a partnership of organizations and agencies; and e) provide linkages or connectivity to other priority wildlife areas. Once adopted, projects are prioritized based on readiness to be implemented, urgency, cost, connectivity, and community support. Habitat protection, restoration, enhancement and assessment work in the estuary is being undertaken by many diverse entities, including public agencies, conservation groups, landowners, corporate interests, local businesses, and citizen volunteers in the nine Bay counties. Based on goals laid out in the SFBJV Implementation Strategy, partners are half way through their timeline and are making great progress towards protecting 63,000 acres, restoring 37,000 acres, and enhancing another 35,000 acres of Bay habitats. They will also work to secure habitat values of adjoining seasonal wetlands and intend to protect 4,000 acres of riparian corridors and restore and enhance over 1,000 miles of creeks. See our associated poster, San Francisco Bay Joint Venture Habitat Goals Accomplishments, for details on progress towards these goals.

Key Words - *Joint Venture; partnership; habitats; restoration; acquisition; enhancement; projects*

Theme: Habitat Restoration and Protection

Poster Board Number: 75. **Submission Number:** 240

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POSTER ABSTRACTS

Assessing Human Communities and Environmental Feasibility of Restoring a Steelhead Salmonid Run in Wildcat Creek and Rheem Creek on Urban Northern San Francisco Bay.

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San Francisco Bay creeks historically with salmonid populations are being to some degree restored, but in this urbanized area, challenges for restoring suitable natural ecosystems are daunting. Obstacles to salmonid recovery can be grouped into three categories, illustrated in comparing two north Bay creeks:

1. Overexploitation: Historically important, but harvest is now prohibited.
2. Degraded Habitat: Destruction and degradation of stream and river habitat as a result of poorly controlled development and other resource exploitation probably remains the greatest challenge to salmonid recovery in urban areas. Requirements for salmonid survival are well understood, but obstacles to restoring those conditions, a major goal of recovery efforts, are often great.
3. Migration Barriers: Physical, chemical, and/or thermal barriers may prevent adult steelhead from returning to their natal stream headwaters to spawn and prevent maturing smolts from reaching the ocean, denying the fish access to the habitat they require to complete their life cycle.

With limited resources available for restoration, a first need is to target creeks and watersheds where greatest amounts of best quality habitat can, with the least expenditure of resources, be saved or restored and made accessible to fishes. Useful tools for performing such cost-benefit analyses are GIS map-databases.

A restoration project involving, from the outset, citizens within the target watershed also can serve as a vehicle for human community and economic renewal, especially in depressed urban areas such as in Wildcat and Rheem Creek watersheds. Local participation in habitat restoration (e.g. shaded riparian corridors, other natural amenities) provides citizens the opportunity to improve their surroundings by enhancing human community environmental quality, as well as offering residents opportunities to facilitate political action re: environmental justice. The land use most compatible with salmon stream riparian zones is parkland, a resource recently in especially short supply in these neighborhoods.

Key Words - *Restoration; creeks; communities; salmonids*

Theme: Habitat Restoration and Protection

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POSTER ABSTRACTS

San Francisco Bay Joint Venture Habitat Goals Accomplishments

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The San Francisco Bay Joint Venture (SFBJV) is one of eighteen habitat Joint Ventures nationally, and brings together a partnership of public and private agencies, conservation groups, businesses, development interests, and others to restore wetlands and other wildlife habitats in San Francisco Bay watersheds and the Pacific coast counties of San Mateo, Marin and Sonoma. In 2001, the SFBJV Management Board adopted Restoring the Estuary as the SFBJV implementation strategy, based on the Baylands Ecosystem Habitat Goals Report, with specific habitat goals for 200,000 acres of San Francisco Bay's tidal flats, marshes, lagoons and seasonal wetlands during a 20-year period. As of July 2009, Joint Venture partners have been responsible for the acquisition of more than 40,000 acres of wetlands, representing almost half of our total acquisition goals. Of the 129,000 acre combined restoration and enhancement goals, approximately 17,000 have been realized since the adoption of the implementation strategy, with more acres currently in planning and implementation phases. Here we provide detailed habitat accomplishments in comparison to targeted goals for each wetland habitat type and conservation action, including acquisition, restoration, or enhancement. This effort also acknowledges partner accomplishments and states the case for ongoing support of wetland restoration and enhancement. The summary reflects over 100 completed wetland protection, restoration, or enhancement projects.

Key Words - *Joint Venture; partnership; habitats; restoration; acquisition; enhancement*

Theme: Habitat Restoration and Protection

Poster Board Number: 76. **Submission Number:** 238

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POSTER ABSTRACTS

San Francisco Bay Eelgrass: Transplantation using TERF-style Frames, and Other Avoidance and Minimization Measures

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Water dependant uses in San Francisco Bay, such as dredging and dock installation, often come into conflict with eelgrass (*Zostera marina*). When impacts to these areas of eelgrass are not avoidable, mitigation is often required in the form of eelgrass transplantation. However, attempts to transplant eelgrass in San Francisco Bay have had limited success due to the often harsh habitat conditions including strong currents, high turbidity, and sediment resuspension. This poster examines the successful transplantation of eelgrass at two project locations in San Francisco Bay, using frames designed based on the Transplanting Eelgrass Remotely with Frame Systems (TERFS). Design of the frames was modified from the TERF to utilize biodegradable materials instead of metal frames. Eelgrass transplantation has been performed using this technique at two project locations in San Francisco Bay, and have met success criteria through two years of monitoring. Avoidance and minimization measures for dock and structure construction are also displayed. Dock avoidance and minimization measures are currently being implemented at projects in San Francisco and Tomales Bay. These techniques present ways to manage the requirements of water dependant uses and eelgrass habitat in San Francisco Bay.

Key Words - *Eelgrass; Dredging; Docks; Piers; Subtidal Habitats*

Theme: Habitat Restoration and Protection

Poster Board Number: 70. Submission Number: 330

Our Actions, Our Estuary
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POSTER ABSTRACTS

San Francisco Bay ecotone vegetation R&M

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Vegetation management is often just hard work: control weeds, amend soils, seed/plant natives, maintain things during establishment, and then some long-term maintenance to ensure the community stabilizes as intended. However in habitats adjacent to San Francisco Bay basic tactics have not meet with success, forcing managers to reconsider dominant paradigms and test novel tactics. One of those paradigms is the “bunchgrass hypothesis”, which proposes a grass-dominated herbaceous community for much of Coastal California’s valleys. Some believe this was due to an inappropriate baseline set after the influences of European activities, but our aesthetics may also play some part in what appears to be a bias against forblands. For three years we have attempted to establish grasses in an effort to preclude invasive forbs during habitat creation, as recommended in a management plan, but found grasses difficult to establish onsite and ineffectual against invasive forbs. Further background research and the casual introduction of a native forb have led us to reconsider that plan.

Key Words - *Restoration; Ecotone; Forbland*

Theme: Habitat Restoration and Protection

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POSTER ABSTRACTS

**Methylmercury production and tidal export associated with Crissy Field Marsh,
Golden Gate National Recreation Area**

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Surface waters in the restored salt marsh at Crissy Field, Golden Gate National Recreation Area, were found to have high aqueous methylmercury (MeHg) concentrations (>1 ng L⁻¹), which was unexpected considering its sandy sediment with low total mercury (THg) concentrations. We sought to determine a) the extent to which the marsh was a source or a sink of MeHg to San Francisco Bay, b) where and when MeHg is produced within the marsh, and c) the potential influence of periodic inlet closure events on sediment and surface water MeHg concentrations. A 24-hour sampling event, over two full tidal cycles was conducted during August 2008, and demonstrated that during this period the marsh was a net source of MeHg, and net sink of THg, to the bay. Sediment percent (%) MeHg (a surrogate measure of MeHg production efficiency) was examined seasonally and across marsh elevations. The intertidal zone (low marsh, cordgrass-dominated) had the highest sediment %MeHg. These concentrations were higher during summer than during winter, highest at the sediment surface, and correlated with sediment organic content. Sediment %MeHg was also elevated during closure events at some intertidal sites. However, aqueous MeHg concentrations (both filtered and unfiltered) fell during inlet closure events. Additional water column data suggest that increased algal production and decreased suspended solids (increased water clarity) may both remove MeHg during closure events, either through settling of mineral and algal components or via photodemethylation. This research suggests that MeHg production is most active in the low intertidal sediments of Crissy Marsh, and driven by the wetting/drying cycles and the comparatively elevated organic matter concentrations in this zone. Despite its protected status, we suggest that the mercury present in Crissy Marsh, whether due to historic contamination, atmospheric deposition or tidal loads, is subject to methylation and export as MeHg.

Key Words - *tidal marsh, restoration, mercury, diel, flux*

Theme: Habitat Restoration and Protection

Poster Board Number: 68. Submission Number: 174

Our Actions, Our Estuary
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POSTER ABSTRACTS

Sulfide is no stress at Crissy Field Marsh but prolonged flooding is: Responses of restored *Spartina foliosa* marsh to periodic inlet closures

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The restoration of 18-acres of historic tidal marsh at Crissy Field has had great success in terms of public outreach and visibility, but less success in terms of revegetated marsh sustainability. Native cordgrass (*Spartina foliosa*) has experienced dieback and has failed to recolonize following extended flooding events during periodic closures of its inlet channel, which inhibits daily tidal flushing. To determine if the marsh closures could be partially responsible for observed marsh dieback, we examined sulfur chemistry and plant stress throughout the marsh between and during closure events. During closures, porewater sulfide concentration did not respond consistently among sites, nor increased to levels likely to cause stress damage to cordgrass. However, sediment solid-phase total reduced sulfur concentrations did respond strongly to closures at both surface and sub-surface depth intervals, and were greatest in sites with high organic matter. The temporal patterns of both porewater sulfide and solid phase reduced sulfur suggests that while sulfate reduction may be enhanced during closure events, the free-sulfide produced is largely precipitated into solid phase, and does not build up to levels that directly cause stress damage to cordgrass. However, plant stress was observed during closures, as indicated by a buildup of ethanol in root tissues at most locations, a byproduct of oxygen limitation and, therefore, fermentative respiration. These data suggest that closure events may be limiting the extent of the current *S. foliosa* community, and limiting possibilities for replanting previously vegetated zones. The National Park Service dredges the inlet channel approximately once a year in the spring after the inlet has been closed for at least 3 weeks. Our data suggest that dredging the inlet channel more often and more quickly, particularly during warmer weather, would promote growth and expansion of the *S. foliosa* community into zones previously occupied by this species.

Key Words - *tidal marsh, restoration, root, sulfur*

Theme: Habitat Restoration and Protection

Poster Board Number: 69. **Submission Number:** 172

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POSTER ABSTRACTS

Evaluating the Potential for Spread of an Invasive Forb, *Limonium ramosissimum*, in San Francisco Bay Salt Marshes

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Because invasive plants threaten San Francisco Bay's salt marsh plant communities, evaluating whether recently introduced species will spread rapidly can help managers prioritize conservation actions. Several populations of *Limonium ramosissimum* (Algerian sea lavender) were discovered in South San Francisco Bay in 2007. While this halophytic forb is invasive in southern California, whether *L. ramosissimum* is likely to spread by rapidly dispersing, recruiting, and reproducing in marshes across the Bay's salinity gradient, is unknown. We floated seeds at different salinities in aquaria to test effects on germination, and grew *L. ramosissimum* from seed to flowering under crossed inundation and salinity treatments in a tidal simulator experiment testing the potential for an estuary-wide invasion. Whether seeds floated for 1, 2, 4, 7, or 14 days or in 0, 15, or 30 salinity water, on average 86.7% of seeds across treatments germinated 16 days after being removed from aquarium tanks- indicating seeds have high dispersal potential. In the second experiment, after two months of *L. ramosissimum* growth in the tidal simulator, regardless of treatment, seedling mortality was extremely low (99.9% survivorship), however both salinity (0, 15, or 30) and inundation treatments (daily, bi-weekly or bi-monthly) affected growth. Plants grew 27 percent faster at salinities of 0 than 30, and 40 percent faster when inundated bi-monthly than daily, indicating while seedling survivorship is high across salinity and inundation gradients, plants will grow more rapidly both in the high marsh and further up-estuary where salinities are lower. *L. ramosissimum*'s potential to spread warrants early removal.

Key Words - *Limonium*; invasion; restoration; salt marsh

Theme: Invasive Species

Poster Board Number: 50. Submission Number: 252

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POSTER ABSTRACTS

Ecological Factors Contributing to Perennial Pepperweed (*Lepidium latifolium*) Expansion in Tidal Marshes of San Francisco Bay

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Perennial pepperweed (*Lepidium latifolium*) is an invasive plant which successfully invades a variety of habitats including agricultural areas, riparian corridors, and tidal wetlands. The ecology of perennial pepperweed in upland areas and along riparian corridors is well-documented. However, less is known about the ecological factors that control perennial pepperweed expansion in tidal marshes. In tidal wetlands, invaded areas form dense, monospecific stands that can expand widely and eventually exclude other plant species.

We have been conducting detailed marsh vegetation mapping in South San Francisco Bay since 1989. This 20 year data set allows us to look at spatial patterns of perennial pepperweed expansion. Our research also examines factors influencing perennial pepperweed expansion, including salinity tolerance, variations in mean sea level and rainfall, microhabitat preferences within marshes, interspecific competition, and the role of levee slopes versus marsh plains in expansion.

With the anticipated restoration of over 15,000 acres of former salt ponds in South San Francisco Bay, the need for a better understanding of tidally invasive species such as perennial pepperweed is crucial to the successful restoration of native tidal marsh communities benefiting federally endangered species such as the California clapper rail (*Rallus longirostris obsoletus*) and the salt marsh harvest mouse (*Reithrodontomys raviventris*). Our research will enhance the ability of managers and restoration planners to identify ecological variables that facilitate perennial pepperweed invasions in tidal wetland areas. This information can then be used to prioritize control efforts in tidal marshes of San Francisco Bay and other tidal salt marshes.

Key Words - *Perennial pepperweed expansion in San Francisco Bay; marsh vegetation mapping in South San Francisco Bay; invasive species in tidal marshes*

Theme: Invasive Species

Poster Board Number: 47. Submission Number: 192

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POSTER ABSTRACTS

An Estuarine Copepod from Asia: Genetic Diversity in Two Recent Introductions

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The estuarine copepod *Tortanus dextrilobatus*, native to estuaries along the coast of southern China, was first reported in Seomjin River estuary, South Korea and San Francisco estuary, USA in the early 1990s. The populations in these two estuaries are thought to have been introduced via ballast water. We obtained samples from these two introduced populations and from one population (Xiamen estuary, China) within the reported native range. We used mitochondrial DNA (cytochrome oxidase c subunit I) to compare genetic diversity in these native and introduced populations in order to test for source populations, test for reduced genetic variation within introduced populations, and determine whether multiple introductions had occurred. We found unexpectedly high haplotype diversity among all populations (86 haplotypes from 94 individuals). There were no shared haplotypes among the sampled populations and thus we cannot identify the source for either introduced population. There was strong bootstrap support for a clade formed by the Xiamen and Seomjin populations and also strong bootstrap support for the sub-clade formed by the Seomjin population. Most of the genetic variation (4% average sequence divergence) was between the San Francisco population and the group formed by the Seomjin and Xiamen populations. The Seomjin population had reduced nucleotide diversity in comparison with the Xiamen population, compatible with a founder effect. The San Francisco population, in contrast, showed no sign of reduced diversity.

Key Words - *invasive species; copepod; population genetics*

Theme: Invasive Species

Poster Board Number: 45. Submission Number: 211

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POSTER ABSTRACTS

Hiding in plain sight: distribution and genetics of morphologically cryptic hybrid *Spartina*

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Spartina foliosa is a valuable component of Pacific coast salt marsh communities. However, since the introduction of *Spartina alterniflora* from the East Coast, hybrid *Spartina alterniflora x foliosa* has become a noxious invader of the San Francisco Estuary, with the potential to degrade the quality of intertidal habitat for native plants, shorebirds and invertebrates. A major control program is underway and has made tremendous progress toward exterminating non-native *Spartina*. However, genetic testing of plants in five marshes revealed a surprising number of hybrid plants. The vast majority of these hybrids derived most of their genetic heritage from native *Spartina foliosa* and had a morphology indistinguishable from the native species. This raises the pressing questions of how the control program can exterminate plants that cannot be visually identified, and if such plants represent a serious problem for the health of estuary. Experiments in progress will characterize the ecological interactions and evolutionary potential of these cryptic hybrids, while new genetic methods are being applied to improve our ability to identify highly backcrossed hybrids.

Key Words - *invasive species; Spartina; salt marsh; intertidal, plant ecology*

Theme: Invasive Species

Poster Board Number: 48. Submission Number: 117

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POSTER ABSTRACTS

California Department of Fish and Game's Invasive Species Program

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The Invasive Species Program at Department of Fish and Game has developed in recent years to include six staff at state headquarters, plus seven staff assigned to regional offices. The majority of these staff, including all regional staff, work solely on controlling the spread of quagga and zebra mussels. Of personnel remaining, one staff member is dedicated to invasive species issues throughout the Bay-Delta. Given limited resources and personnel compared to the size of the invasive species problem in California, the Invasive Species Program must prioritize and plan projects strategically.

The California Aquatic Invasive Species Management Plan, approved by the Western Regional Panel of the Aquatic Nuisance Species Task Force and signed by the Governor in 2008, guides a large portion of our work. This Plan provides a framework for how state agencies will coordinate with one another on aquatic invasive species issues and also addresses coordination with federal agencies, research institutions and stakeholders. It identifies and prioritizes 163 specific actions organized under the following eight objectives for the management of aquatic invasive species in California: coordination and collaboration, prevention, early detection and monitoring, rapid response and eradication, long-term control and management, education and outreach, research, and laws and regulations.

In addition to working on actions identified in this Plan, one of the program staff works on terrestrial weed management through participation in the California Interagency Noxious and Invasive Plant Committee, the Weed Management Area Advisory Council, and administration of a set of specially-funded weed management projects on DFG lands.

Key Words - *invasive species; fish and game*

Theme: Invasive Species

Poster Board Number: 53. **Submission Number:** 105

Grazing Impact of the Overbite Clam on the Microzooplankton Assemblage of the San Francisco Estuary

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The overbite clam *Corbula amurensis* has altered the San Francisco Estuary since its introduction in 1986. Feeding by *C. amurensis* is believed to be the cause of a substantial decline in phytoplankton biomass and in the abundance of some zooplankton species. Previous studies have demonstrated high feeding rates of *C. amurensis* on phytoplankton, bacteria, and copepod nauplii. To understand how *C. amurensis* affects pelagic food webs, we need to know what they are eating and how rapidly they feed. A potential source of prey not previously examined are microzooplankton, specifically tintinnid ciliates. Microzooplankton are defined as heterotrophic eukaryotes 20–200 µm in size, which includes copepod nauplii, rotifers, aloricate ciliates, and tintinnid ciliates. Microzooplankton provide a key link in pelagic foodwebs. They consume phytoplankton and bacteria, and in turn are eaten by mesozooplankton, >200 µm. The primary objectives of this study are to (1) quantify the current abundance of microzooplankton in the Low Salinity Zone of the San Francisco Estuary (salinity < 5) and (2) measure clearance rates of *C. amurensis* on microzooplankton, including tintinnid ciliates. Tintinnid abundance was monitored monthly at US Geological Survey water quality monitoring stations and compared to published data gathered before the clam was introduced. Preliminary estimates of clearance rate of *C. amurensis* on microzooplankton ranged from 173 to 444 mL ind⁻¹ h⁻¹. This project will advance our understanding of the abundance of microzooplankton in the San Francisco Estuary and their role as a food source for *C. amurensis*.

Key Words - *Bivalve; Microzooplankton; feeding*

Theme: Invasive Species

Poster Board Number: 42. **Submission Number:** 97

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POSTER ABSTRACTS

Hybrid Assimilation in *Spartina*: Re-evaluating Conservation Goals

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Hybridization between native and introduced species of *Spartina* (cordgrass) have significantly altered wetland habitats and created challenges for conservation in locations around the world. Since the hybridization between introduced smooth cordgrass (*Spartina alterniflora*) and native Pacific cordgrass (*S. foliosa*) was first documented in the San Francisco Bay, California, USA, in the early 1990s, we have witnessed the population explosion of invasive hybrids and the development of a genetically variable hybrid swarm. The California Coastal Conservancy's San Francisco Estuary Invasive *Spartina* Project (ISP) has systematically removed plants with obvious hybrid morphology or ecology as they work to eradicate invasive *Spartina* from the San Francisco Estuary. In the course of monitoring eradication efforts, we use genetic testing to determine the parentage of hundreds of cordgrass samples each year. The results of these genetic tests show that highly backcrossed hybrid plants, with no obvious morphological characteristics to distinguish them from natives, are "hiding" in the marshes of the Bay. Through the process of adaptive management, the ISP and the conservation community must now evaluate the extent of these "cryptic hybrids" and set realistic conservation goals based on the current and projected extent and consequences of hybrid assimilation.

Key Words - *Spartina*; management; wetland; marsh; restoration

Theme: Invasive Species

Poster Board Number: 49. Submission Number: 166

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POSTER ABSTRACTS

Evaluation of the Effects of the Herbicides on the Highly Endangered Lange's Metalmark Butterfly (*Apodemia mormo langei*)

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The Lange's metalmark butterfly is in imminent danger of extinction due to the loss of habitat and food source, naked stem buckwheat (*Eriogonum nudum* var. *auriculatum*). These losses are primarily caused by invasive plants that significantly impact the few remaining acres of habitat at the Antioch Dunes National Wildlife Refuge. The use of herbicides is a common tool to control invasive plant species. Coincidentally, herbicide application occurs during the Lange's metalmark butterflies sensitive larval stage. Due to the lack of literature regarding butterflies and herbicide direct toxicity and the declines in native butterflies it is quite clear that a study evaluating the effects of herbicides on butterflies is necessary. We have evaluated the effects of several commonly used herbicides on a surrogate species, Behr's Metalmark. The effects of these herbicides on Behr's Metalmark will be discussed.

Key Words - *herbicide, butterfly, invasive species*

Theme: Invasive Species

Poster Board Number: 52. **Submission Number:** 250

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POSTER ABSTRACTS

Field Assessment of Bayluscide Treatments for the Control of New Zealand Mud Snails

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The invasive New Zealand mud snail (NZMS) *Potamopyrgus antipodarum* was discovered in California in 2000 and has the potential to reach high densities, disrupt native food chains, and impact water delivery systems. The molluscicide Bayluscide (active ingredient: niclosamide) was tested in a concrete-lined irrigation canal in Solano County for effectiveness against NZMS. Test snails were exposed to niclosamide concentrations of approximately 1 mg/L for 8 or 17 hours. The results of this study indicate that almost complete mortality was seen in the treatments. The half-lives of niclosamide in water and sediment were 1.8 and 1.6 days, respectively.

Key Words - *bayluscide; niclosamide; New Zealand mud snail; invasive species; Potamopyrgus antipodarum*

Theme: Invasive Species

Poster Board Number: 43. Submission Number: 158

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POSTER ABSTRACTS

Metabolic Responses to Environmental Salinity in the Invasive Clam *Corbula amurensis*

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The Asian or overbite clam *Corbula amurensis* is believed to have caused a large shift in the pelagic food web in the northern part of San Francisco Bay since its introduction in the 1980s. This shift is believed to be due to the clam's high density and filtration rates. We have investigated the metabolic responses of *C. amurensis* following acclimation to constant or fluctuating salinities. We measured growth rate, feeding rate, respiration rate, and activities of enzymes involved in metabolism and ion regulation in acclimated clams. On average, clams did not grow during a three-month period at either high or low salinity. Clams fed faster following acclimation to high salinity. Activity of malate dehydrogenase (MDH), an overall indicator of metabolism, did not differ significantly with respect to acclimation salinity, however means were higher at high salinity. In comparison to other bivalve species *Venus mercenaria* and *Venerupis japonica*, *C. amurensis* had significantly higher MDH activities. Activities of citrate synthase had a positive relationship with respect to acclimation salinity, suggesting higher respiration rates at higher salinities. Activity of Na⁺/K⁺ ATPase, an ion regulation enzyme, may be higher following acclimation to elevated salinity, suggesting that the higher metabolic rates could be to support osmoregulation. Overall, our data suggest that clams experiencing higher salinities may have a higher metabolic demand and filtration rate, but put less of their metabolic energy into growth or reproduction.

Supported by CDWR-IEP grant to Wim Kimmerer and Jonathon Stillman.

Key Words - *Corbula amurensis*; salinity; clam physiology; invasive; san francisco bay

Theme: Invasive Species

Poster Board Number: 41. Submission Number: 149

Our Actions, Our Estuary
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POSTER ABSTRACTS

Fouling-Related Practices of Vessels in California

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Fouling of aquatic organisms to the submerged areas of vessels can be a major vector for the transfer of nonindigenous species (NIS), especially within the San Francisco Bay-Delta Estuary which received over 4100 commercial vessel arrivals during 2008. Introduction of NIS through vessel fouling can occur as organisms spawn, fall off, or are physically removed from the underwater areas of a vessel. However, the risk of NIS introduction through this vector is difficult to assess because of the limited amount of information on vessel practices that influence fouling accumulation. In order to fill this information gap, the California State Lands Commission (Commission) has developed a Hull Husbandry Reporting Form that all vessels operating in California must submit annually, as of January 2008. This reporting form is a ten-question survey aimed at gathering information related to practices that are likely to influence fouling extent on the submerged areas of vessels. These include hull husbandry practices, such as type and age of antifouling coating and length of time since the last drydocking or in-water cleaning, as well as certain voyage characteristics, such as traveling speeds and port residency times. A complete look at these fouling-related practices for all vessels operating in California during 2008 will be presented. These forms indicate that 97% of all vessels operating in California have been removed from the water for cleaning and treatment with antifouling coatings within the past five years, and 87% of those vessels have used an antifouling coating containing at least one biocide. The information gathered from this form over the next several years will provide detailed insight into characteristics thought to influence vessel fouling and will be used in conjunction with fouling-related research the Commission is currently funding to guide development of regulations governing the management of fouling on vessels operating in California.

Key Words - *Fouling; Nonindigenous Species; Invasive Species; Shipping*

Theme: Invasive Species

Poster Board Number: 39. **Submission Number:** 124

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POSTER ABSTRACTS

Feeding and reproduction of *Acartiella sinensis*, an introduced predatory copepod in the Low Salinity Zone of San Francisco Estuary

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The San Francisco Estuary is a highly invaded aquatic ecosystem, and most of the zooplankton community of the northern estuary are exotic species. *Acartiella sinensis*, introduced in 1993 from the Asian mainland, is a member of a common tropical-subtropical coastal genus. Although known by its morphology to be predatory, almost nothing else is known of this genus except for its spatial and temporal distribution. It is now one of the numerically dominant copepod species in the Low Salinity Zone (LSZ) in summer (3,000 individuals m⁻³). Recent declines in the abundance of several pelagic fish species in the LSZ have prompted further investigation into the foodweb of this region. Planktonic invertebrate predators can significantly influence the distribution and composition of their zooplankton prey; these predators therefore may play an important role in regulating community structure. We determined *A. sinensis* abundance and conducted the first experiments on its feeding and reproductive rates in an effort to understand its role in the LSZ foodweb. In our initial feeding experiments we examined predation on a very abundant, co-occurring introduced species, *Limnoithona tetraspina*. Preliminary results suggest that adult female *A. sinensis* will consume *L. tetraspina* nauplii (average ~25% of prey offered, or ~7 nauplii female⁻¹ d⁻¹). Predation on *L. tetraspina* copepodites and adults was low and variable, suggesting these life stages may be less susceptible to predation by *A. sinensis*. The reproductive effort of *Acartiella sinensis* females averaged 13 eggs female⁻¹ d⁻¹ over 3 experiments. This moderate egg production rate is greater than those of the co-occurring calanoids *Pseudodiaptomus forbesi* and *Eurytemora affinis* (2-3 eggs female⁻¹ d⁻¹), suggesting that *A. sinensis* may be supplementing its diet with prey other than *Limnoithona tetraspina* nauplii. This has implications for energy transfer to higher trophic levels, including declining fish species, in the region.

Key Words - *introduced species; copepod; zooplankton; predation; feeding; egg production*

Theme: Invasive Species

Poster Board Number: 44. Submission Number: 236

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POSTER ABSTRACTS

Birds and invasive plants: A review of interactions and management considerations

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Invasive plants alter ecosystems in a variety of ways, most of which are assumed to be detrimental. Ecological effects are one of the criteria used by Cal-IPC to rate invasive plants; however, the effects of invasive plants on wildlife are unknown for most systems. During research for the 2006 Cal-IPC Inventory update, we found few published studies examining direct interactions between birds and invasive plants. For this poster, we reviewed available studies of the relationship between birds and invasive plant species in the San Francisco Estuary and Delta region. Available information ranges from qualitative observations to fine-scale GIS-based spatial modeling. We will summarize case studies representing a range of invasive plants and avian communities. For some species, strong data shows the negative effects of invasive plants on birds and the benefits of removing weeds. Other invasive plants appear at first glance to have a positive effect on measures such as avian density but may in fact be “ecological traps” that reduce the birds’ nesting success. In still other cases, the results are mixed depending on the avian species of interest. Understanding these interactions becomes increasingly critical as land managers and policy makers develop long-term plans to buffer wildlife species against climate change, plans that may include prioritizing which invasive plants to remove and where.

Key Words - *invasive species; invasive plants; birds; climate change*

Theme: Invasive Species

Poster Board Number: 51. Submission Number: 265

Our Actions, Our Estuary
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POSTER ABSTRACTS

Continued Presence of the Chinese Mitten Crab in the San Francisco Bay and Delta.

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The San Francisco Bay-Sacramento and San Joaquin Delta system has 234 known non-native species and potentially hundreds more. Once established, these species can pose a significant threat to threatened and endangered species (ANSTF 2005). One aquatic invasive species of concern in the Bay-Delta system is the Chinese mitten crab, *Eriocheir sinensis*. Shortly after its discovery in San Francisco Bay in 1992, the population increased until reaching an estimated peak in 1998 with a steady decline in population after this peak. Three surveys to investigate zoeae, megalopae, and juvenile abundance in the Bay-Delta have been conducted between 2007 and 2008. The purpose of these ongoing surveys is to determine the current status of the Chinese mitten crab population in the Bay-Delta and to test the efficacy of the monitoring methods. California Department of Fish and Game plankton tow samples taken from San Pablo Bay were analyzed for zoeae; light trap samples were deployed in areas of San Pablo Bay and analyzed for megalopae; and passive trapping for juvenile crabs occurred in south Bay tributaries. *E. sinensis* zoeae had the lowest abundance in 2007 and 2008. A total of six megalopae were caught in light traps during 2007 and 2008. No juveniles were captured in the passive traps deployed in south Bay tributaries. Reports of *E. sinensis* being captured as bycatch by fishermen and in scientific trawls have been rare in recent years. Although present in low numbers, the Chinese mitten crab is still found in the San Francisco Bay-Delta system. Information gained through continued monitoring and assessments of monitoring efficacy will be useful in developing effective early detection techniques and identifying potential population controls for this invasive species in the San Francisco Bay-Delta and other areas on the east and west coasts.

Theme: Invasive Species

Poster Board Number: 40. Submission Number: 179

Our Actions, Our Estuary
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POSTER ABSTRACTS

Control and Management of Perennial Pepperweed Invasion: An Obtainable Goal?

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Perennial pepperweed (*Lepidium latifolium*) is an aggressive, non-native weed that has invaded wetland and riparian areas throughout California, including the San Francisco Bay and Sacramento-San Joaquin Delta Estuary. At Rush Ranch, a brackish marsh in the San Francisco Bay National Estuarine Research Reserve, we applied a three-pronged approach to understanding and managing pepperweed: (1) mensurative experiments documenting impacts of perennial pepperweed on the sediment community and food web (2) eradication experiments evaluating efficacy and non-target impacts of herbicide control in a tidal marsh and seasonal wetland context, and (3) symposium series designed to bring together researchers and managers to assess and share the current state of knowledge regarding perennial pepperweed's ecological impacts, the extent of invasion in the greater Bay Area, and best practices for control. Within the high marsh zone, the presence of pepperweed significantly increased soil humidity and altered the diversity and composition of the surrounding plant, invertebrate and insect communities. We hypothesize that these changes will lead to cascading impacts throughout the entire food web. In mid and low elevations, the effects of perennial pepperweed are reduced due to constant inundation and soil saturation. In a seasonal wetland infested with pepperweed, we compared two herbicide treatments (Imazapyr and 2,4 D) applied to plots in May 2007 and monitored at 1 month, 6 months, 1 year and 2 years following application. Two years of 2,4D were not effective in controlling pepperweed but had minimal non-target impacts on the native plant community. Imazapyr reduced pepperweed cover by more than 90% compared to untreated controls, but non-target impacts on the native plants were severe and persistent. Our data provide important information about the consequences of perennial pepperweed invasion, about effective control techniques, and about developing an integrated and informed making process for perennial pepperweed control.

Key Words - *perennial pepperweed; invasive species; integrated management*

Theme: Invasive Species

Poster Board Number: 46. **Submission Number:** 147

Our Actions, Our Estuary
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POSTER ABSTRACTS

Improved detection of ammonia, nitrate and total N in surface water samples

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Recent pelagic organism decline in western waterways, especially the San Joaquin and Sacramento River delta in northern California, USA, has increased interest in the nitrogen cycles in these systems. Ammonia, nitrate, nitrite, particulate and dissolved organic nitrogen, and total nitrogen are important part of the nutrient cycle and of the food web, and an overabundance of any of these nutrients can cause serious environmental problems. Relative levels of $\text{NO}_3\text{-N}$, $\text{NH}_3/\text{NH}_4^+\text{-N}$ (TAN), along with ambient flow, pH, and temperature will effect levels and toxicity of inorganic N, and as little as 0.07 mg/L TAN has been shown to affect $\text{NO}_3\text{-N}$ uptake by diatoms. Detection of inorganic N compounds in surface waters necessitates the analysis of a minimum of four species: $\text{NO}_3\text{-N}$, TAN, $\text{NO}_2\text{-N}$ and Total N. There exist several current analytical methods for detection of N compounds including ion-selective electrodes, colorimetric methods, high temperature combustion with chemiluminescence detection, and conductimetric methods. The conductimetric method can has the advantage of automation, and recent developments have lowered the quantification limit to 5 $\mu\text{g/L}$, allowing accurate measurement of inorganic N species at biologically relevant levels. The objective of this study is to evaluate the performance of the conductimetric method for quantifying total TAN, nitrate ($\text{NO}_3\text{-N}$), and total N in a wide variety of environmental samples including surface water, wastewater effluent, biogas digester effluent, and agricultural drain water. Included is a comparison of the range of detection, minimum detection limits, accuracy, interferences, the time and level of difficulty, and the hazardous wastes created by various methods of analysis for these nutrients.

Key Words - *ammonia, nitrate, total N, water quality, analytical chemistry*

Theme: Pelagic Organism Decline

Poster Board Number: 122. Submission Number: 168

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POSTER ABSTRACTS

Largemouth bass abundance and diet in the Sacramento-San Joaquin Delta: investigating temporal and spatial variation with respect to submerged aquatic vegetation

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Concurrent with the recent decline of numerous pelagic organisms in the Sacramento-San Joaquin Delta, fish assemblages in the littoral zone have also undergone dramatic changes. In particular, populations of largemouth bass and other non-native centrarchid fishes have grown remarkably. Previous field studies have hypothesized that the growth of largemouth bass populations is linked to the expansion of invasive aquatic macrophytes in shoreline areas of the Delta. This study investigates the potential role of the expanding largemouth bass population in the decline of pelagic organisms in the Delta as well as the association between largemouth bass with submerged vegetation. At thirty-three sites across the Delta, we surveyed fish assemblages, sampled largemouth bass diets, and quantified the biomass of the submerged vegetation on a bimonthly basis from October 2008 through August 2009. Fish assemblage varied regionally, with native fishes maintaining their strongest presence in the north and west Delta, while centrarchids dominated central, south, and eastern regions. Largemouth bass abundance and size structure varied with respect to the vegetation landscape rather than its biomass: large, piscivorous bass are found predominantly on patch edges and in structured shoreline areas where little or no submerged vegetation is present. However, juvenile bass are concentrated in the interior portions of the vegetation patches. Largemouth bass diet composition is dominated by vegetation-associated prey items across all seasons, such as smaller centrarchid fishes, crayfish, and amphipods, suggesting that largemouth bass do not stray far from nearshore areas to forage. These results indicate that the spread of submerged vegetation provides largemouth bass with prime nursery habitat to support the growing population and its dietary preferences.

Key Words - *largemouth bass; aquatic macrophytes; Delta littoral zone*

Theme: Pelagic Organism Decline

Poster Board Number: 121. **Submission Number:** 324

POSTER ABSTRACTS

Total and Un-ionized Ammonia Concentrations in the Upper San Francisco Estuary from 1974-2009: A Comparison of Ambient Data and Toxicity Thresholds

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Concerns have been raised about whether direct ammonia toxicity is contributing to the Pelagic Organism Decline (POD) in the San Francisco Estuary. In order to address these concerns, ammonia concentrations from over 11,800 water samples collected during 35 years (1974-2009) at 81 stations were screened for exceedances of US EPA acute and chronic toxicity criteria for ammonia. Monitoring stations were located throughout the legal Delta and Suisun Bay, and into San Pablo Bay. Stations were categorized as “estuarine” or “freshwater” using salinity data according to procedures established by the California Toxics Rule. This designation affected whether saltwater or freshwater EPA criteria were applicable for determining exceedances in individual water samples. At estuarine stations, the freshwater acute criterion was stricter than the saltwater acute criterion for ~90% of samples, but the saltwater chronic criterion was stricter than the freshwater chronic criterion for ~80% of samples. Over the entire record, the screening resulted in zero exceedances of the US EPA acute criterion, and only 2 exceedances of the US EPA chronic criterion. None of the measurements of ammonia exceeded Species Mean Acute Values for fish or invertebrate species in the current EPA freshwater and saltwater databases - including that of the most sensitive salmonid species (rainbow trout). None of the ammonia measurements exceeded the currently estimated 96h LC50 or LOEC for Delta smelt.

Key Words - *ammonia; toxicity; upper San Francisco Estuary*

Theme: Pelagic Organism Decline

Poster Board Number: 120. **Submission Number:** 333

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POSTER ABSTRACTS

Phytoplankton productivity in Suisun Bay and Rio Vista may signal “bad” habitat conditions

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The need to understand causes of pelagic fish declines in the SF Estuary/Delta have led to food web studies to evaluate bottom-up effects. One hypothesis is that contaminants such as elevated anthropogenic ammonium (NH₄) or herbicides with riverine or Delta sources are inhibitory to phytoplankton resulting in little chlorophyll or poor food quality. Funded by CALFED, we proposed that phytoplankton physiology be used to indicate unfavorable conditions and underlying mechanisms. We compared phytoplankton productivity and nutrient uptake rates in Suisun Bay and Rio Vista to those of Central Bay and used “grow-out” experiments to evaluate phytoplankton status. A parameter, *f*, assessed the proportion of nitrate (NO₃) uptake compared to total inorganic nitrogen uptake (NO₃ plus NH₄ uptake). High NO₃ uptake (i.e. $f \geq 0.5$) correlates with bloom formation and high primary production. In Central Bay where NH₄ concentrations (and other contaminants) are low, chlorophyll blooms occurred; the phytoplankton used NO₃ and there was elevated primary production. Grow-outs showed complete NO₃ drawdown within 4 days. In Suisun Bay, with higher ambient NH₄, blooms were rare, nutrient uptake and primary production were low. Grow-outs showed slow NH₄ drawdown and delayed NO₃ uptake. In some grow-outs complete nutrient drawdown occurred after 5 days, with chlorophyll accumulation and higher *f* values. However at Rio Vista, influenced both by Sacramento River and Cache Slough sources of contaminants, NH₄ concentrations were the highest observed, chlorophyll was low and extremely low nutrient uptake and primary production rates were measured. All Rio Vista grow-outs showed no NO₃ drawdown and *f* was <0.5. Grow-outs, *f* and phytoplankton productivity could be developed as an adaptive management approach to evaluate habitat condition in the northern estuary and Delta.

Key Words - *phytoplankton; ammonium; primary productivity;*

Theme: Pelagic Organism Decline

Poster Board Number: 119. **Submission Number:** 112

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POSTER ABSTRACTS

Seabird Education Awareness on Alcatraz: Reducing Disturbance Through Education

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Environmental education and outreach programs are an effective tool for reducing human-caused disturbance to wildlife and increasing public awareness. In the San Francisco Bay area, there is a significant lack of public awareness of the nesting seabirds on Alcatraz Island. PRBO's data document that nesting seabirds on Alcatraz are subjected to a substantial amount of disturbance from human activity, particularly walking, boating, and flying too close to seabird nesting sites. To reduce human caused disturbance to seabirds, education staff at PRBO Conservation Science created a multi-visit classroom and field seabird education program, "SEA Alcatraz." The SEA Alcatraz program focuses on three topics related to seabirds on Alcatraz: marine food webs, seabird ecology and conservation, and human-caused seabird disturbance in San Francisco Bay and on Alcatraz Island. After completing SEA Alcatraz, student awareness of human-caused disturbance, the marine food web, and seabird ecology and conservation issues increased. Students gained an awareness of Alcatraz as important wildlife habitat and demonstrated their knowledge of the threat of human disturbance to seabirds through the creation of outreach materials for marine user groups. Students created outreach posters urging people to reduce disturbance to seabirds on Alcatraz by boat, aircraft and foot; respect and protect seabirds for their role in the food web; and respect the environment. Posters were distributed to marine user groups around San Francisco. Student posters and additional marine user outreach has contributed to decreased disturbance to the seabirds of Alcatraz as documented by PRBO data. SEA Alcatraz is one of many necessary steps to raise awareness of the value of public places for wildlife habitat, reduce human caused disturbance, and help foster a more conservation-minded local and global community.

Key Words - *seabird; disturbance; education; conservation*

Theme: Public Education

Poster Board Number: 92. Submission Number: 77

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POSTER ABSTRACTS

National Estuarine Research Reserve's Education Programs: Effectively (and Easily) Broaden the Impact of Your Research Through Partnership

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NOAA's National Estuarine Research Reserve System strives to improve the management of our nation's estuaries through integration of research and education. San Francisco Bay National Estuarine Research Reserve offers education programs that share results of research conducted in the Reserve sites and elsewhere in the estuary with the public, K-16 students and teachers, and coastal decision makers. There are several ways that estuarine scientists can partner with San Francisco Bay NERR's education programs to effectively inform or involve these audiences. Options for partnership range from easy, no-cost opportunities like the provision of simple content for use in our "Research in the Reserve" poster series, to working with our Coastal Training Program to develop workshops that provide science, tools, and techniques to decision makers.

Key Words - *broader impacts; outreach; Rush Ranch; China Camp; education*

Theme: Public Education

Poster Board Number: 93. Submission Number: 189

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POSTER ABSTRACTS

Science-Based Delta Restoration Curriculum

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The Restoration Trust (Trust) has developed an environmental education program for fourth grade classes to be used in conjunction with restoration of the tidal and upland habitats at the Shin Kee site located in Stockton, California. The Shin Kee restoration site is a 142-acre tidal marsh that was constructed in the fall of 2008. The environmental education program emphasizes hands-on activities, presentation skills and inquiry learning. The Trust developed the curriculum based on California State science standards and worked with educational consultants to reflect opportunities or weaknesses in current school programs. The curriculum focuses on Delta food webs, the formation of the Delta, and current challenges facing the Delta.

The Trust developed a 16-page Student Field Book that includes site-specific information, a “Road Trip” through the Delta’s major ecosystems, a glossary of science terms, specific places for students to record their fieldwork, observations, results and conclusions, plant and wildlife keys, and activities that develop science vocabulary. The 24-page Teacher’s Guide includes a reproduction of the student book, explanations of class and fieldwork, details how fieldwork addresses content standards, and provides a description of pre- and post- classroom visits.

The Trust leads classroom and fieldtrips in both the fall and spring to explore Shin Kee and engage in site experiments. In the fall, the classroom day is centered on Delta formation. During the fall field day, students plant bulrush and measure their size to see how much they will grow by the next field day. They also look at a cut within the soil to observe soil characteristics in the marsh. In the spring, the classroom session focuses on food webs and primary productivity in the Delta. In the field, students measure the growth of their planted bulrush and conduct a phytoplankton pull.

Key Words - *environmental education; delta; restoration; shin kee; tidal marsh; food web; delta formation*

Theme: Public Education

Poster Board Number: 96. **Submission Number:** 87

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POSTER ABSTRACTS

The Watershed Project's Clean Shorelines Initiative

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Marine debris is a problem for oceans, coasts and watersheds around the world, and humans are the cause of it all. Our single-use mentality and "out of sight, out of mind" relationship towards human waste, especially garbage, is threatening the healthy survival of our waterways. The San Francisco Bay is in critical condition due to high pollution levels, most of it flowing from our local creeks. The fundamental problem is the culturally dysfunctional relationship between urban communities and nature, stemming from a lack of understanding of the impacts of litter and the connectivity between our creeks, shoreline, bay and ocean.

The Clean Shoreline Initiative (CSI), is designed to reconnect urban communities to nature, resulting in long-term behavioral change. Our holistic approach includes a community-based marine debris prevention, reduction and removal program that integrates K-12 education, public outreach, and volunteerism. Through this combination, the CSI program will actively remove debris from local waterways and educate local communities on how to reduce and prevent marine debris.

To date, we have facilitated efforts among Bay Area citizens of all ages, from both private and public sectors, to stop littering and start stewarding. Last year, we reached over 200 teachers and over 4,000 students through our education campaigns. Moreover, two thousand volunteers came out for 30 clean up events, removing over 8,174 lbs of trash from our creeks and shorelines. We are using Urban Rapid Trash Assessment Surveys to assess the composition and quantity of trash that accumulates in hotspots around West Contra Costa and North Alameda County, and plan to track this data and compare changes over a five year period.

The CSI vision is a Bay Area citizenry that appreciates and actively stewards our waterways. By changing our cultural view of watersheds, we shall change our behavior, and reduce riparian and marine debris.

Key Words - *education; outreach; marine debris; pollution prevention*

Theme: Public Education

Poster Board Number: 97. Submission Number: 101

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POSTER ABSTRACTS

Environmental Science Academy at Oakland High

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The Environmental Science Academy (ESA) at Oakland High School (OHS) is highly focused on educating the urban youth about the environment and how much impact humans have on the environment. Students apply to join the academy at the end of their freshmen year and are accepted in their sophomore year of high school. Once accepted, they take both biology and environmental studies their sophomore year. As seniors, they are required to take Advanced Placement Environmental Science. During the sophomore year, students go to Lake Merritt every Tuesday to study the lake's water quality and establish baseline data for the lake. Additionally, throughout the year, students in the ESA can go on various trips to places ranging from the Catalina Island Marine Institute in southern California to Lake Tahoe in northern California; moreover, all trips involve a college tour so students are allowed to increase their knowledge of colleges to help them make wiser choices when applying. Students who are part of the ESA at OHS also volunteer with environmental groups like EarthTeam and Save the Bay to clean up local creeks, plant native plant species at marshes, collect electronic waste, and etc. Not only does this benefit the local community, it also helps the students to understand that simple actions can help the environment. These experiences make them aware of the importance of the Bay in our lives and the need to protect its water quality, wildlife and beauty.

Key Words - *ESA; Oakland; High; EarthTeam; Save the Bay; Environmental Science Academy*

Theme: Public Education

Poster Board Number: 95. Submission Number: 104

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POSTER ABSTRACTS

Overcoming the Tragedy of the Commons via Persuasive, Educational Surveys

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With the Tragedy of the Commons, the self-interested majority favors a climate-harming policy because of perverse individual incentives. “If only I change, I’m worse off; if we all change, we’re all better off ... hence, I won’t change.” Self-interested Bay Area majorities favor two climate-harming policies: a) Prefer Not-In-My-Back-Yard (NIMBY) land use policies over regional smart growth to minimize driving, b) Prefer free suburban workplace parking to subsidize solo commuting over green commute alternatives. Two persuasive surveys provide a “fair” set of pro/con policy arguments for #a and #b (where “fair” follows political science “framing” theory). The pro-climate arguments are based on a richer set of facts, but the main argument is an explanation of the Tragedy, followed by an appeal for long-term over short-term optimization. Both surveys were sufficiently persuasive to “change belief” to bring about a pro-climate voting majority. [Research funding provided by U.S. Environmental Protection Agency’s Transforming Office Parks into Transit Villages Study.]

Key Words - *NIMBY; smart growth; parking; commuting*

Theme: Public Education

Poster Board Number: 98. **Submission Number:** 253

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POSTER ABSTRACTS

Environmental Science Academy of Oakland High

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ESA isn't only just the Environmental science academy of Oakland High, a learning opportunity for inter-city students about the Environment, it's also a community outreach effort. It starts out for most students during the 10th grade with a 2 period block of classes. The students could have taken other classes, like a PE class or an Art class that they need to finish but they decide not to. Then as the year progresses the new sophomores come down to the local lake for a hands-on learning experience. The 60 students of that year of ESA are grouped together, forming a community amongst themselves. Once their sophomore year is finished the students spend a break from the environmental sciences, but are still grouped in their community in their junior yr. During this time and into college the students are offered a wide variety of trips from tours of UC Merced, white water rafting, and snorkeling in the vast ocean. Then during the academy students' senior they take the AP course of environmental sciences a vigorous course like other AP classes. Once a graduate these students may come back to provide to the community as environmentally educated leaders. Graduates will contribute to the protection and preservation of our community and even our bay with their education. Even if the ESA alumni do not work in the environmental sciences field because they know how to make a difference. Once they show that they as individuals can make a difference, they will get others in their community to step up also. That is the mission of the Environmental Science Academy, we don't only reach out to our own students, we reach out to the community around us.

Key Words - *ESA ; School ; intercity ; academy ; student*

Theme: Public Education

Poster Board Number: 94. Submission Number: 218

Our Actions, Our Estuary
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POSTER ABSTRACTS

Giving wetlands a voice

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The San Francisco Bay Joint Venture (SFBJV), one of 18 habitat Joint Ventures nationally, is a partnership of public agencies, environmental organizations, the business and agricultural community and local governments all working to protect, restore, increase and enhance the wetlands and watersheds of the San Francisco Estuary.

We have two websites, both considered invaluable tools for outreach. **www.sfbayjv.org** is our internal website serving our network of over 100 partners with useful and timely information about wetland related funding, projects, issues, jobs and events. The website is promoted through our extensive mailing list through a bimonthly electronic bulletin.

For the more general public we offer **www.yourwetlands.org**, which features downloadable audio programs including bimonthly podcasts about wetland related issues and the people doing the work to protect them. We also offer audio tours of the bay, including our most recent posting of three stop, learn and listen locations in the South Bay.

The poster will highlight some of our outreach tools, including information about the tours:

- To inspire creativity and the use of social media as an important component to any outreach strategy.
- To highlight and promote our recent audio tours of the South bay.

Key Words - *outreach; education; podcasts; audio; social media; wetlands*

Theme: Public Outreach

Poster Board Number: 99. **Submission Number:** 80

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POSTER ABSTRACTS

San Francisco Estuary and Watershed Science

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San Francisco Estuary and Watershed Science is an online scientific publication that serves to educate the interested public, inform the scientific community and encourage informed discourse and public involvement by providing free access to peer-reviewed scientific research about the Delta, the Estuary, its watersheds, and the adjacent ocean. The journal publishes the latest scientific knowledge describing the health, importance, and critical issues affecting the Estuary. For example, since 2003 SFEWS has published 16 papers that address both climate change and sea level rise and their effects on the estuary. The information provided by SFEWS also addresses the nexus between scientific research performed in the Estuary, its conclusions, and its affect on water management policies and the future of the Sacramento-San Joaquin Delta and San Francisco Estuary. The impact of SFEWS has grown since its inception in 2003, as evidenced by a steady increase in the number of articles down-loaded per year and its inclusion in important international search engines. Our goal is to make the latest peer-reviewed research about the region readily available for people to discover, digest, and discuss, recognizing that credible science is a critical ingredient if the community is to take effective action on behalf of the Estuary.

Key Words - *San Francisco Estuary; Sacramento-San Joaquin River Delta; scholarly publication; on-line journal; open-access; research; climate change; water management policy; sea level rise; effective action; peer review*

Theme: Research Journal

Poster Board Number: 18. Submission Number: 139

POSTER ABSTRACTS

Managing Salt Ponds to Increase Waterbird Nesting Habitat While Minimizing Methyl Mercury Biomagnification: Implications for the South Bay Salt Pond Restoration Project

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The South Bay Salt Pond Restoration Project plans to convert 50-90% of salt ponds into tidal marsh. However, salt ponds are currently preferred habitat for many migrating and breeding waterbirds. Wetland managers plan to enhance the remaining salt ponds to maintain current waterbird numbers, yet it is unclear how to manage salt ponds to simultaneously increase waterbird foraging and nesting opportunities while minimizing the deleterious effects of methylmercury production. We conducted a pilot study on the Don Edwards San Francisco Bay National Wildlife Refuge and created numerous nesting islands by lowering the water level in Pond A12 and exposing submerged substrate. In response, we documented nearly 600 waterbird nests in this pond despite it having no prior nesting. Nest success was 29% for avocets and 38% for Forster's terns, which was slightly lower than some neighboring ponds, probably due to California gull depredation of eggs. This generally positive benefit of increased nesting habitat for waterbirds, however, was mediated by the potential increased production of methylmercury. We found that Forster's tern, American avocet, and black-necked stilt eggs had higher mercury concentrations in Pond A12 than in any other wetland monitored. Additionally, we found that fish mercury concentrations in Pond A12 spiked in the summer after water levels were lowered in early spring to expose nesting islands. In contrast, fish mercury concentrations in a control pond (Pond A11) actually decreased throughout the summer. We found similar differences between the manipulated and control ponds' surface water chemistry, with Pond A12 having higher phytoplankton and methylmercury concentrations compared to Pond A11. These preliminary data indicate that although we successfully created nesting habitat for waterbirds, methylmercury production may have been enhanced due to water management actions and methylmercury subsequently biomagnified up the food web. Further study is warranted to determine if these results are common among managed salt pond habitats in San Francisco Bay.

Key Words - *mercury; wetland management; bioaccumulation; birds; fish; water quality*

Theme: Salt Pond Restoration

Poster Board Number: 82. **Submission Number:** 106

POSTER ABSTRACTS

**Rapid Changes in Small Fish Mercury Concentrations in Estuarine Wetlands:
Implications for Wildlife Risk and Monitoring Programs**

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Small fish are commonly used to assess mercury (Hg) risk to wildlife and monitor Hg in wetlands. However, limited research has evaluated short-term Hg variability in small fish, which can have important implications for monitoring programs and risk assessment in predators. We conducted a time-series study of Hg concentrations in two small fish species representing benthic (longjaw mudsuckers [*Gillichthys mirabilis*]) and pelagic (threespine sticklebacks [*Gasterosteus aculeatus*]) food-webs within three wetland habitats in San Francisco Bay Estuary. We simultaneously monitored prey deliveries, nest initiation, and chick hatching dates of breeding Forster's terns (*Sterna forsteri*), the most abundant nesting piscivore in the region. Mudsuckers and sticklebacks were the predominant prey fish, comprising 36% and 25% of tern diet, and Hg concentrations averaged (geometric mean \pm SE, $\mu\text{g/g dw}$) 0.44 ± 0.01 and 0.68 ± 0.03 , respectively. Fish Hg concentrations varied substantially over time following a quadratic form in both species, increasing 40% between March and May then decreasing 40% between May and July. Importantly, Forster's terns initiated 68% of nests and 31% of chicks hatched during the period of peak Hg concentrations in prey fish. These results illustrate the importance of short-term temporal variation in small fish Hg concentrations for both Hg monitoring programs and assessing wildlife risk.

Key Words - *mercury; biosentinel; fish; risk; salt ponds; monitoring*

Theme: Salt Pond Restoration

Poster Board Number: 80. **Submission Number:** 224

POSTER ABSTRACTS

Napa Plant Site Restoration – Construction Lessons Learned and Incorporation into Subsequent Engineering Design

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Problem Statement: How to better utilize available data and modeling tools to design inter-tidal restoration projects to maximize habitat benefit, while reducing construction cost. Approach: The California State Coastal Conservancy (Conservancy), California Department of Fish and Game (CDFG), and the Army Corps of Engineers (USACE) are in the process of implementing ecological restoration of the former Cargill salt pond complex in the North Bay, which is now owned by the California Department of Fish and Game. The proposed restoration at the Napa Plant Site includes approximately 1,460 acres. Phase 1 construction has been completed or is near completion for approximately 340 acres of the site, and a large portion of this has been breached to Fagan Slough. Phase 2 restoration design of the remainder of the site will be going out to bid this coming fall and has received approximately \$8.5M of ARRA funds for construction. The overall goal for the project includes the establishment of self-sustaining tidal and seasonal wetlands that provide habitat for a broad range of migratory shorebirds and waterfowl, marsh-dependent birds, mammals, fish and other aquatic organisms, and threatened and endangered species. This poster focuses on lessons learned from Phase 1 construction and breach monitoring data that can inform and improve future restoration design. Results: Lesson learned during the Phase 1 construction, in addition to monitoring data completed during and after the breach, provide interesting feedback to inform final design for the remainder of the site. This feedback is applicable to inter-tidal restoration design and construction projects throughout the bay to help balance habitat benefit versus construction cost. Conclusions Issues to be addressed include breach design and implementation, construction techniques for channel excavation, extent of channel excavation necessary to balance successful habitat evolution, incorporation of habitat refuge islands, and erosion control techniques for wind generated waves within newly implemented wetland restoration sites.

Key Words - *Salt Pond; Restoration; Construction*

Theme: Salt Pond Restoration

Poster Board Number: 88. **Submission Number:** 249

Our Actions, Our Estuary
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POSTER ABSTRACTS

Integrating Avian Datasets for Management, Modeling, and Visualization

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The 2003 purchase of more than 15,000 acres of salt ponds in San Francisco Bay created North America's second largest habitat restoration project. Utilizing an adaptive management framework, the South Bay Salt Pond Restoration Project (SBSRP) requires access to historical and current data to assess past actions and inform future management. PRBO Conservation Science, U.S. Geological Survey, and San Francisco Bay Bird Observatory have initiated a collaborative project to make all available avian data accessible to SBSRP managers. These data represent millions of dollars in investments, and will provide the SBSRP with accurate baseline estimates of bird numbers and a measure of progress for current activities. The Integrated South Bay Avian Database (ISBA-DB) utilizes the industry-proven infrastructure of the California Avian Data Center (<http://www.prbo.org/cadc>) to organize and facilitate the synthesis and visualization of avian data in the South Bay. Modeling efforts will help set restoration targets and assist the SBSRP team to make informed management decisions. The application will provide the information required to determine data needs and prioritize future collection efforts. The new system allows new data to be instantly available for managers and restoration assessment. Linkages between ISBA-DB and the existing South Bay Salt Pond Project Database will provide managers with even more decision-support resources. The ISBA-DB project team will be working directly with the SBSRP project leads to ensure that the metrics and data summarizations are those needed for project assessment and planning. In addition, training and support will ensure the tools are immediately used.

Key Words - *informatics; modeling; salt pond restoration; restoration assessment; adaptive management; monitoring*

Theme: Salt Pond Restoration

Poster Board Number: 87. Submission Number: 239

POSTER ABSTRACTS

Seasonal Dynamics of Surface Water Mercury Speciation and Partitioning in Two Contrasting South San Francisco Bay Salt Ponds: The Influence of Primary Production

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One goal of the South Bay Salt Pond Restoration Project is to increase wildlife habitat. To this end, and to accommodate planned changes in Pond A8 that would decrease bird nesting habitat, Pond A12 was partially drained to increase interior island habitat for nesting birds. As part of a larger study to investigate the effectiveness of this management action on bird nesting recruitment, we examined water column mercury (Hg) dynamics in Pond A12 and compared and contrasted these to a control pond (A11), which was not partially drained. The focus was to examine (a) Hg-speciation (total mercury [THg], methylmercury [MeHg] and reactive inorganic mercury [Hg(II)R]) and Hg-partitioning (dissolved vs. particulate) within these two managed ponds, and (b) the extent to which observed Hg dynamics are influenced by temporal/spatial changes in water column primary production (as chlorophyll-a) and total suspended solids (TSS). Surface water was sampled bimonthly, between January and September 2008. Key findings include: (a) the vast majority of both THg and MeHg was associated with the particulate phase (TSS); (b) whole water concentrations for all three Hg species were consistently higher in Pond A12 than in A11, which paralleled the findings for THg concentrations in bird eggs and fish; (c) the partitioning of both THg and MeHg between the filtered and dissolved phases varied more dramatically in Pond A11 than in Pond A12; (d) a significant increase in the percentage of THg that was Hg(II)R, between January and May in Pond A12; (e) this was followed by both filtered and particulate MeHg peaking in Pond A12 during July, which also corresponded to a peak in chlorophyll-a and TSS; (f) salinity, chlorophyll-a and TSS were all consistently higher in Pond A12 compared to A11; and (g) there was a significant positive correlation between surface water salinity and chlorophyll-a (all data). It is unclear if the difference in Hg dynamics between the two ponds was directly due to the partial draining of Pond A12, as no baseline data prior to the draining event was available. However, these results do suggest that pond salinity is linked to phytoplankton density, which in turn affects the concentration and speciation of Hg in the particulate phase, and ultimately Hg concentration in biota.

Key Words - mercury; salt ponds; primary production

Theme: Salt Pond Restoration

Poster Board Number: 81. Submission Number: 200

Our Actions, Our Estuary
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POSTER ABSTRACTS

Assessing Differences in Food-web Mercury Associated with Restoring Salt Ponds to Tidal Marsh in South San Francisco Bay

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During 2006 – 2008, water, sediment, and resident biota (biosentinels) were sampled to address the question of how methylmercury in the food web might change if Pond A8 in the Alviso area were restored to tidal action. Biosentinel animals representative of particular sub-habitats in tidal marsh and salt ponds were selected and tested as indicators of mercury condition. Previous work has shown that some wetlands may be sites of methylmercury production, and concentrations of methylmercury in San Francisco Bay are known to be above levels of concern for some wildlife and for people who eat sport fish. Consequently, there is a concern that the planned restoration of salt ponds to tidal marsh may increase the amount of methylmercury accumulated in the local food web. The biosentinel species were used to compare different areas and management choices and to provide a pre-restoration baseline for mercury condition in these habitats. This study design aimed to give managers an idea of how methylmercury in local biota might change as Pond A8 was converted from salt pond to marsh. Results indicated that Pond A8 in its current salt pond state has some of the worst mercury conditions in the South Bay food web. Higher concentrations of methylmercury were seen in fish and flies from Pond A8 than from the surrounding marsh and pond habitats. The fringing marsh in Alviso Slough across the levee from Pond A8 is the best available indicator of what future mercury conditions might be in the restored Pond A8 marsh. Biosentinels from the fringing marsh had lower mercury than the same biosentinel species from Pond A8 and had similar mercury concentrations compared to reference marshes across South Bay. These results suggest that future restoration of Pond A8 to tidal marsh is likely to improve the mercury condition in the food web.

Key Words - *Salt Pond Restoration; Mercury; Biosentinels*

Theme: Salt Pond Restoration

Poster Board Number: 79. Submission Number: 257

Our Actions, Our Estuary
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POSTER ABSTRACTS

Western Snowy Plovers in the San Francisco Bay: Determining Nest Success, Predators and the Effects of Habitat Enhancements.

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The Western Snowy Plover (*Charadrius alexandrinus nivosus*) is a threatened species that nests on dry salt ponds in the San Francisco Bay. The number of snowy plovers in the Bay area has decreased over the past 30 years. The majority of plover habitat in the Bay is within the South Bay Salt Pond Restoration Project area, which will impact the amount of nesting habitat available. We estimated nest success at Eden Landing Ecological Reserve in Hayward and the Don Edwards San Francisco Bay National Wildlife Refuge in Alviso, Fremont and Menlo Park from 2004 through 2008. Nest success for all sites combined decreased from 83.6% in 2004 and 85% in 2005 to 58% in 2006 and 67% in 2008. The decrease in nest success in 2006 through 2008 was due to high predation rates. In 2008, 41.5% of the nests were depredated (n=89), compared to 10% of the nests in 2005 (n=20) and 4.9% in 2004 (n=59). Nest predation was attributed mostly to Common Ravens (*Corvus corax*), Northern Harriers (*Circus cyaneus*) and California Gulls (*Larus californicus*). In 2009, we deployed nest cameras to determine nest predators and captured footage of California Gulls, Northern Harriers, Common Ravens and Red-Tailed Hawks (*Buteo jamaicensis*) depredating Snowy Plover nests. Additionally, we used a randomized block design to test the effectiveness of habitat enhancement projects to reduce nest predation and increase nest density. Preliminary data indicates that plots enhanced with oyster shells increase nest success and nest density.

Key Words - *Snowy Plover*

Theme: Salt Pond Restoration

Poster Board Number: 86. Submission Number: 123

Our Actions, Our Estuary
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POSTER ABSTRACTS

Rapid sediment accumulation in a restoring tidal salt marsh in the South Bay Salt Pond Restoration Project

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Sediment accumulation is a critical factor driving the development of restored tidal marshes as elevation increases to a point suitable for vegetation establishment. This issue is particularly important for highly subsided tidal wetland restoration sites. In 2006, a large-scale restoration of industrial salt evaporation ponds was initiated in South San Francisco Bay, California, and we have monitored short and long-term sediment dynamics for the past 3 years within the first site to be restored. Prior to tidal restoration, the former salt pond lacked vegetation and was covered by a solid, dense gypsum layer up to 25 cm thick, overlying remnant marsh vegetation, sediment, and channels. We installed PVC sediment pins across the site to monitor long-term sediment dynamics and examine within-site sedimentation patterns. For short-term, mass-based accumulation rates, we used a modification of the “filter paper method”, deploying sample discs over a two-week tidal period. Substantial sediment accumulation has occurred since tidal restoration in March 2006, with approximately 12-14 cm of sediment accumulating at lower elevations over the first year alone, with even greater accumulation in particular locations. Sediment depth decreased with distance from breach, which also corresponds with an underlying elevation gradient. Accumulation rates at higher elevations were variable but lower in magnitude; however, sediment accumulation was orders of magnitude higher than in most natural tidal wetlands. Short-term, mass-based measurements of accumulation reflect similar spatial variability across the pond and show that substantial sediment accumulation has occurred throughout most of the year. Three years since restoration, the sediment depth ranged from 1 to 57 cm and native vegetation is colonizing rapidly along channel edges. These results give an indication of the potential for sediment accumulation during the critical initial restoration period for subsided tidal marshes.

Key Words - *South Bay Salt Pond Restoration Project; sedimentation rates; tidal salt marsh*

Theme: Salt Pond Restoration

Poster Board Number: 84. Submission Number: 259

Our Actions, Our Estuary
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POSTER ABSTRACTS

Green Biomass Machines: Primary Productivity in the Former Salt Ponds of South San Francisco Bay

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Over 6110 ha of the commercial production salt ponds surrounding South San Francisco Bay, CA have been decommissioned and reconnected to the Bay, most as part of the South Bay Salt Pond Restoration Program. The open water ponds are critical habitat for millions of birds annually and restoration program managers must determine the appropriate management of ponds that will be maintained as open water habitats. This study describes the metabolism of these new systems and their ecological value as feeding habitats for birds. We determined metabolic parameters in one pond from high resolution timeseries of dissolved oxygen concentration. Areal gross primary production (8.17 g O₂ m⁻² d⁻¹) was roughly double the world's most productive estuaries. High rates of phytoplankton photosynthesis were balanced by high rates of community respiration (8.25 g O₂ m⁻² d⁻¹), revealing a rapid biomass producing and consuming system. Pond metabolic equilibrium was delicately poised, sharp irradiance and temperature shifts triggered short term photosynthesis reduction resulting in oxygen depletion. The result of net primary production routed through simple food webs was high potential forage production and energy supply to waterbirds, equivalent to 11-163 million planktivorous fish or 19-78 billion small estuarine clams within the pond between May and November. The pond's beneficial food supply function is challenged by its potential to produce toxic or inedible algae, and susceptibility to hypoxia. Our study provides the first measurement of primary production in the open water ponds of San Francisco Bay and presents a novel approach for transforming primary production into forage production as a metric of an ecosystem's energetic carrying capacity.

Key Words - *salt pond, primary production,*

Theme: Salt Pond Restoration

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POSTER ABSTRACTS

Sediment salinity distribution along the tidal channel networks of a restored salt pond in the San Francisco Bay-Delta Estuary system

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Restoration of solar salt producing ponds back into salt marsh is one ongoing Bay Area project that has recently gained focus and momentum. Following the levee breaching of salt ponds in the Don Edwards San Francisco Bay Wildlife Refuge in March 2006, tidal inundation has started to naturally restore the salt marshes. Adaptive management, a continual, iterative process of studying the restoration site, and then implementing changes and corrections from the results, is being used to manage the ponds. Research monitoring the annual progress of sedimentation concluded that two years since the breaching, tidal action has deposited considerable amounts of sediment on the surface of the salt pond. Sediment salinity is a basic indicator of favorable conditions for vegetation recruitment. Vegetation recruitment has started on the surface of the pond; however, only sporadically and in certain areas. Since tidal channels are the main conduits by which sediments enter and leave the pond, I conducted a study of the tidal channels in Pond A21, investigating sediment salinity with respect to distance to nearest levee breach and along the assumed tidal channel flow path.

Theme: Salt Pond Restoration

Poster Board Number: 85. **Submission Number:** 129

POSTER ABSTRACTS

Literature Review of Unconsolidated Sediment in San Francisco Bay and Nearby Pacific Ocean Coast

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A review of the geologic literature regarding sedimentation in the San Francisco Bay estuarine system shows that the main part of the bay occupies a structural tectonic depression that developed in Pleistocene time. Eastern parts, including San Pablo Bay and Suisun Bay, have had sedimentation throughout late Mesozoic and Tertiary. Carquinez Strait and the Golden Gate may represent antecedent stream erosion. Sedimentation has included estuarine, alluvial, and eolian deposition. The ages of estuarine deposition includes the modern high sea level stand and earlier Pleistocene interglacial periods. Sediment sources can be generally divided into the Coast Ranges, particularly the Franciscan Complex, and "Sierran". Much of the estuarine system is floored by very fine sediment, with local areas of sand floor. Near the Golden Gate, sediment size decreases in both directions away from the deep channel. Bedforms include sand waves (submarine dunes), flat beds, and rock and boulders. These are interpreted in terms of dominant transport directions. Near the Golden Gate is an ebb-tidal delta on the outside (including San Francisco bar) and a flood-tidal delta on the inside (parts of Central Bay). The large tidal prism causes strong tidal currents, which in the upper part of the estuary are normally much stronger than river currents, except during large floods. Cultural influences have altered conditions, including hydraulic mining debris, blasting of rocks, dredging of navigation channels, filling of the Bay, and commercial sand mining. Many of these have served to decrease the tidal prism, correspondingly decreasing the strength of tidal currents.

Key Words - *Sediment*

Theme: Sediment

Poster Board Number: 89. **Submission Number:** 69

Our Actions, Our Estuary
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POSTER ABSTRACTS

Vessel-based LIDAR to monitor coastal change and offshore dredge efforts at Ocean Beach, CA.

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Previous studies have identified an erosion “hot spot” at the southern end of Ocean Beach, which threatens beach width, recreation usage and coastal infrastructure including a sewage outflow pipe. The 2004 Ocean Beach Coastal Processes Study monitoring, mapping and modeling effort revealed possible shoreward sediment transport at an undersea region just offshore of south Ocean Beach. In 2005, a test dredge disposal site was implemented in the region identified by the 2004 Ocean Beach Coastal Process

Study with a goal to reduce sediment loss and beach erosion at Ocean Beach. The purpose of this research is to determine the current state of the Ocean Beach topography relative to its state in 1998, and to determine the efficiency of vessel-based topographic LIDAR for mapping coastal geomorphology. My approach has been to analyze 2009 vessel-based LIDAR data and 1998 NOAA airborne LIDAR data to quantify the spatial distribution of coastal erosion and deposition at Ocean Beach. The 2009 data are currently being compared to data from 1998 using raster subtraction in ArcGIS. Results will be ready for disclosure at the upcoming San Francisco Bay Estuary Conference in September.

Theme: Sediment

Poster Board Number: 91. Submission Number: 220

Our Actions, Our Estuary
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POSTER ABSTRACTS

A Legacy of Contaminants in SF Bay and Wetland Cores

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With residence times often on the order of decades or even longer, sediments can serve as a reservoir of legacy pollutants long after new inputs have been greatly reduced or stopped altogether. San Francisco Bay has been listed as impaired by pollutants, including mercury, copper, and PCBs. A previous study found these and other pollutants in cores of deeper Bay sediments at a few depositional locations, a potential reservoir of legacy contaminants that could threaten ecosystem health if these areas were later exposed by erosion. Since it has been over 15 years since that investigation, a new coring study was undertaken to characterize the Bay at a wider range of sites. Cores were collected from 6 wetland and 11 sub-tidal Bay sites, radiodated, and analyzed for a suite of trace metal and organic pollutants. Cores from depositional wetland areas showed sharp peaks in concentrations of pollutants such as copper and mercury, generally corresponding to expected periods of high pollutant loads and ambient concentrations. In contrast, subtidal cores from open-water areas of the Bay showed generally elevated pollutant levels, but with less distinct or no peaks in concentration. These patterns suggest long-term dispersion and mixing of past loads in Bay open waters, which would require cleanup of less concentrated but ever larger sediment volumes with passing time, or waiting many more decades for concentrations to dilute or disperse to levels that no longer impair the ecosystem. Although deep sediment contamination appears not to be as widespread or severe as once feared, these results underscore the importance of controlling pollutants at or near their sources, where management actions can be applied most effectively and efficiently.

Key Words - *sediment; pollutant; core*

Theme: Sediment

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POSTER ABSTRACTS

Green Infill Clean Stormwater

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Detrimental impacts of stormwater runoff from transportation infrastructure have been well documented. The Green Infill Clean Stormwater Project promotes sustainable green streets and parking lots by developing approaches to reduce impacts of water pollution from road runoff. The reductions will be achieved through the construction of rain gardens, bio-swales, infiltration- and flow-through planters, curbside extensions, or a combination of these techniques and monitoring to evaluate their effectiveness. A first set of samples was collected during storm rainfall in the winter and spring of 2009 from a parking lot/recreational complex prior to the implementation of best management practices. Concentrations of trace metals were high during the pre-construction sampling, from 7 (Ni) to 296 (Zn) times higher in runoff from the parking lot compared to the 14-year Central Bay average from the Regional Monitoring Program for Water Quality in the San Francisco Estuary (RMP). Concentrations for total Hg, dissolved Hg, and MeHg were also high, between 5 (HgT) and 15 (Hg diss) times higher than found in the Bay. The relatively toxic gasoline additives benzene, toluene, and xylene or BTX were not detected in any of the collected samples. The highest concentrations for diesel (5,000 ug/L) and gasoline (3,000 ug/L) did not exceed LC50s for *Daphnia magna* (LC50 = 19.2 mg/L), chironomid larvae (LC50 = 238 mg/L), *Viviparus bengalensis* (LC50 = 185 mg/L), or freshwater fish (LC50 32 – 30,000 mg/L).

Key Words - *stormwater; San Francisco Bay; contaminants*

Theme: Stormwater

Poster Board Number: 113. **Submission Number:** 180

Our Actions, Our Estuary
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POSTER ABSTRACTS

Implementing Sustainable Green Streets and Parking Lots in San Mateo County

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Problem Statement: Roads and parking lots provide important opportunities for managing stormwater because they constitute as much as 70 percent of the total impervious cover in ultra-urban landscapes. In 2007 San Mateo Countywide Water Pollution Prevention Program (SMCWPPP) initiated the Sustainable Green Streets and Parking Lots Program to help implement stormwater treatment measures and low impact development (LID) in San Mateo County, and to particularly address the adverse impacts of transportation infrastructure on water quality and beneficial uses. **Approach:** SMCWPPP developed the San Mateo County Sustainable Green Streets and Parking Lots Design Guidebook to help municipal staff identify and realize green street and parking lot opportunities, by providing visual simulations of green street opportunities, solutions to common implementation barriers and guidance on how to design, construct, and maintain successful projects. SMCWPPP has also provided a green streets training workshop, and offered grant funding to construct LID measures for two parking lot and four roadway improvement projects in the County. The green streets and parking lots program is funded with a vehicle license fee, with a long-term goal of bringing about small but widespread changes that will improve the health of San Mateo County's watersheds. **Results:** The Guidebook, training workshop and grant funding have led to the implementation of green street and parking lot projects, which have been constructed or are currently in the design or construction phases in San Mateo County. **Conclusions:** The visual simulations and design guidance in the Guidebook, training workshop, and real-world low impact development examples of green street and parking lot projects, are helping to demonstrate practical, sustainable stormwater designs that can be implemented throughout San Mateo County and beyond.

Key Words - *Stormwater runoff and innovative treatment; green streets; low impact development*

Theme: Stormwater

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Our Actions, Our Estuary
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POSTER ABSTRACTS

Water Sensitive Schoolyards in San Francisco

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The San Francisco Public Utilities Commission (SFPUC) received an Administrative Civil Liability (ACL) Complaint from the San Francisco Bay Regional Water Quality Control Board for an unauthorized discharge during a significant rainstorm in the winter of 2006. The ACL included the option to develop Supplemental Environmental Projects (SEPs). In an effort to turn the incident into an opportunity to implement green infrastructure in San Francisco and educate residents about stormwater issues, the SFPUC formed a partnership with two local non-profits, the Green Schoolyard Alliance and Life Frames, Inc., and the San Francisco Unified School District to implement stormwater-related projects in five of San Francisco's public elementary schools. These projects will be multi-purpose: they will include a rainwater harvesting component, which will both manage stormwater and provide a water source for school gardens; they will remove impervious surfaces, which will minimize stormwater runoff from schoolyards, allow stormwater to percolate into the ground, and allow for planting of natives and edibles; and they will include outdoor classrooms for students, teachers, and garden coordinators. The final element funded through this effort is the creation of a San Francisco-specific, watershed-based curricula to help teachers around the district introduce students to their local watersheds. If looked at individually, the five projects appear isolated from one another. But taken together, they embody an approach that aims to retrofit San Francisco's urban watersheds site by site. These schools join a growing number of projects, both retrofits and new developments, which are using stormwater as a resource and increasing permeability city-wide. By collecting rainwater for use in the schoolyard, increasing pervious surfaces across the district, and educating part of a new generation of San Francisco watershed stewards, each small project brings San Francisco closer to becoming a water sensitive city.

Key Words - *Stormwater management, rainwater harvesting, watershed stewardship, green schoolyards, watershed education*

Theme: Stormwater

Poster Board Number: 112. **Submission Number:** 209

Our Actions, Our Estuary
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POSTER ABSTRACTS

The Lathrop Urban Drainage Study: Background and Study Design

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Urban development in the Sacramento- San Joaquin River Delta has converted agricultural land into urban communities. This has resulted in an increase in impervious cover, which translates to higher flows of runoff with high concentrations of contaminants flowing directly to the rivers and sloughs. The focus of this study is on Lathrop, a small community in the south delta. Because Lathrop is small, we will be able to assess current land use and water quality conditions and be able to monitor changes in this community as it continues to grow. By doing this, we will be able to use Lathrop as a model for other small communities that are growing in the delta.

Sampling will be conducted during storm events, taken along the San Joaquin and Old Rivers and in Lathrop's pumping stations. These stations pump Lathrop's stormwater from the city out to the San Joaquin River, which flows directly into the estuary. Samples along the rivers will be grab samples collected by boat; samples in the pumping stations will be collected by autosamplers. Analysis of the data will be focused on environmental and drinking water quality constituents of concern. A land use analysis will use GIS to determine the overall impervious cover of Lathrop. This study is still in its beginning stages. Sampling will start in the fall of 2009 and will continue for at least 2 years.

This study will provide a good understanding of how urban growth of cities like Lathrop affects the estuary's water quality. This information is vital to developing well informed policy decisions about water quality in the delta.

Key Words - *urban drainage; south delta; carbon loading*

Theme: Stormwater

Poster Board Number: 114. **Submission Number:** 68

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POSTER ABSTRACTS

Community-based Shoreline Habitat Restoration- Save The Bay

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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

Our Actions, Our Estuary
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POSTER ABSTRACTS

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

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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

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POSTER ABSTRACTS

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

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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 occurred, 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 hepatotoxins 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

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POSTER ABSTRACTS

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

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Estuaries have been identified as potential net sources of CO₂ to the atmosphere. Bacterial respiration of organic matter entering the estuary leads to supersaturated levels of CO₂. 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 pCO₂ 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 pCO₂ 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 CO₂ level reported for the San Francisco Estuary and this indicates that portions of the estuary are a sink for atmospheric CO₂ 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 CO₂ 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 CO₂ exchange.

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

Theme: Water Quality and Phytoplankton

Poster Board Number: 123. **Submission Number:** 116

Our Actions, Our Estuary
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POSTER ABSTRACTS

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

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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.

Key Words - *Water Quality Monitoring, Lake Merritt. Diverting Water issues;*

Theme: Water Quality Monitoring; **Poster Board Number:** 126. **Submission #:** 208

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POSTER ABSTRACTS

Recent Time Series of Water Quality in San Pablo Estuary

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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

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POSTER ABSTRACTS

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

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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

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POSTER ABSTRACTS

Potential Benefits of the Delta Corridors Plan

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The Delta Corridors Plan would connect the San Joaquin River (SJR) with the estuary at Franks Tract, and would separate the SJR salt and fish from export pumping. The entire SJR flow would be diverted into Old River and down Grant Line Canal to Old River. Old River between Grant Line Canal and Coney Island would be divided to separate the SJR flow from the water supply flow to the CVP and SWP exports. The SJR flow would cross over the Victoria Canal water supply corridor at the north end of Coney Island. Four barriers would be constructed with boat locks to separate the Middle River water supply corridor from the SJR-estuary corridor in Old River.

The CVP and SWP fish facilities would continue to operate, although with fewer fish and much less debris because of the separation of the SJR. The primary louver bypass flows (of about 250 cfs) from each facility would be pumped into Old River, to allow the salvaged fish to return to the SJR-estuary corridor, improving the salvage efficiency by about 25% for all fish. The Delta Cross Channel (DCC) would be opened and fish screens would be installed at DCC and Georgiana Slough.

Potential benefits of the Delta Corridors Project would be: (1) reduced salinity at the exports, (2) wastewater discharges would be separated from drinking water intakes, (3) full exports during the VAMP period, (4) Sacramento fish would be separated from the water supply corridor, (5) Delta smelt spawning in the lower San Joaquin River or along Old River would no longer be subject to entrainment losses, and (7) The risk of water supply interruption from levee failure events would be reduced.

Key Words - *Delta conveyance; export salinity; fish entrainment; fish screens; San Joaquin River*

Theme: Water Use and Management

Poster Board Number: 116. **Submission Number:** 177

Our Actions, Our Estuary
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POSTER ABSTRACTS

Water and the City: What influences urban water supply and sanitation decisions?

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Sustainable urban water use and infrastructure are critical components of long-term planning for the San Francisco Estuary. Cities and the Estuary are tightly linked: the Estuary system provides water to over two thirds of California residents, but it is also vulnerable to the activities that take place there. Better understanding is needed of the decision making processes and incentives that shape these links. This research documents the institutional and political features of local urban water management in California and explores the influence these features have on decision making about recycled water, water conservation, utility pricing, and storm water capture in 55 California cities. The results point to gaps in the policy system that, if filled, could help ensure a sustainable link between cities and the San Francisco Estuary system.

Key Words - *water management, urban water use, policy*

Theme: Water Use and Management

Poster Board Number: 117. **Submission Number:** 167

POSTER ABSTRACTS

Collaborative governance and adaptive management: Lessons from California's CALFED Water Program

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Both for its technological and institutional innovations and for its history of conflicts, California's water system has been one of the most observed in the world. A forthcoming Special Issue of Environmental Science and Policy on the CALFED Bay-Delta Program continue in this tradition. CALFED is likely the most ambitious experiment in collaborative environmental policy and adaptive management the world has seen to date. This Issue moves beyond the celebratory tone of other analyses of collaborative, adaptive management and looks closer into how collaborative networks work to produce innovation, and more importantly to reflect also on their inherent contradictions, limitations and "dark sides". While collaborative governance enhances mutual understandings and can be a source of innovation, it appears ill-suited to resolve alone the distributive dilemmas at the core of many water – and other environmental – conflicts. A lacuna in existing research concerns the institutional design of effective boundaries and linkages between democratic politics, legitimate authority, and adaptive governance, i.e. the mix of institutions that can provide sufficient responsibility, accountability and democratic legitimacy, without choking off the self-organizing interaction, shared learning, and communication that is at the heart of collaboration. A painful realization in the Delta is that environmental conservation and further growth may be fundamentally at odds; efficient win-win solutions, institutional or technological, seem insufficient to satisfy the competing demands posed upon the system. Radical decisions and changes might be necessary, but they seem unlikely under current institutional arrangements and political conditions.

Theme: Water Use and Management

Poster Board Number: 115. **Submission Number:** 335

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POSTER ABSTRACTS

Severity of the 2007-2009 drought in the Sacramento River watershed and corresponding reductions in Delta diversions and outflow

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Precipitation in the watershed of the Sacramento River in water years 2007-2009 has been below average. Some of this precipitation has been stored in reservoirs, released to flow downstream to the Delta and Bay, and pumped out of the Delta by the State and Federal water projects. Drought and pumping limitations intended to benefit the Delta ecosystem have curtailed water exports from the Delta. The objectives of this study are to evaluate 1) how severe the 2007-2009 drought is compared to other 3 year droughts dating back to 1920, 2) the corresponding reduction of Delta water exports, and 3) the corresponding reduction in Delta outflow. Analysis of an index of eight precipitation stations in the Sacramento River watershed indicates that precipitation during the 2007-2009 drought was at the 16th percentile of all three year periods since 1920. Delta pumping and Delta outflow volumes obtained from the DWR DAYFLOW computer program are compared to historic pumping and outflow rates. These results quantify the severity of the drought, reduced water exports from the Delta, and reduced Delta outflow to San Francisco Bay.

Key Words - *Precipitation; Drought; Sacramento River; Pumping; Delta*

Theme: Water Use and Management

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POSTER ABSTRACTS

How are we doing? Developing a watershed scorecard for the Napa River and Sonoma Creek watersheds

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The Sonoma Creek and Napa River communities share a need for tools that focus attention on watershed management, describe current conditions and trends, and provide a common vocabulary for discussing natural resource stewardship in their watersheds. To meet this need, we are developing a “Watershed Health Scorecard,” a simple one-page report card, modeled after the San Francisco Bay Index, on the condition of our natural resources, backed by the best science available. The first focus for each watershed's Scorecard was water supply. We selected five indices to answer the question: how is the watershed doing at providing enough water, now and in the future, for people and nature? Each index is composed of one or more indicators, which will be scored for the 2007 water year based on a reference condition or management target. The data and science behind the scores will be posted in detail on the web. We learned several lessons from developing the Scorecard in two watersheds simultaneously. For example, for optimum transferability, indices should be designed to adapt to the data and characteristics of individual watersheds, because we found that available data and ecosystem drivers varied considerably, even in two adjacent watersheds. We discovered that index and indicator selection is the biggest hurdle in creating the scorecard. Another challenge lies in accounting for, and reporting transparently, uncertainties in scores and trends. We hope the Scorecards will be re-scored regularly in the future, to facilitate better watershed management.

Key Words - *indicators; targets; watershed; water supply*

Theme: Watershed Management

Poster Board Number: 106. **Submission Number:** 107

Our Actions, Our Estuary
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POSTER ABSTRACTS

Environmental Data Upload and Visualization Tools

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Easy access to reliable data is a primary objective of any environmental information management system. Providing high quality, scientific information allows for the formulation of technically sound policies and the ability to address specific management questions. Tools can assist with the flow of information through the various data management steps of data collection and uploading, and facilitate the retrieval, exchange, and visualization of results. This poster highlights tool development from two projects. The Regional Monitoring Program for Water Quality (RMP) is the primary source of long-term contaminant monitoring data for the San Francisco Estuary and annually collects water, sediment, and tissue samples. The South Bay Mercury Project (SBMP) is a collaborative, three-year project that characterizes mercury in the sediment, water, and sentinel species indicative of different landscape management endpoints in South Baylands. Field data collection entry forms have been developed in Microsoft Access for both projects and enable data to be easily uploaded into a database. These entry forms have reduced staff time in the field and costs for entering standardized information into project databases. Constraints prevent entry of erroneous data by providing standard code lists. The RMP makes its 15-year dataset available online through a user-defined query tool, from which results can be downloaded into Excel in both a cross-tabulated and flat-file format. Dynamic mapping of concentrations allows users to view spatial distributions across the Estuary, and statistical functions, such as cumulative distribution function plots, provide aggregated summaries. The SBMP uses Google Earth for reporting mercury results at specific sample sites. Concentrations are distinguished using a range of colors and symbol heights. This visualization tool provides scientists with a valuable aerial perspective for evaluating results. These visualization tools are powerful methods for conveying information in meaningful ways to environmental managers and scientists responsible for managing the Estuary's resources.

Key Words - *visualization tools; data management*

Theme: Watershed Management

Poster Board Number: 107. **Submission Number:** 215

Our Actions, Our Estuary
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POSTER ABSTRACTS

Linking Groundwater with Stream and Wetland Systems

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Streams and wetlands are intimately linked with groundwater resources. Locally, groundwater discharging into the San Francisco Bay and tributary systems may affect tidal, near-shore, and riparian habitats. Unfolding the nexus between surface water and groundwater systems leads to effective management of water resources. Basic calculation of a hydrologic budget bounds the surface water and groundwater contributions and may reveal the vulnerability of creeks and water bodies to diversions and groundwater withdrawals. Pollutants associated with contaminated industrial sites and contaminants from urban and agricultural runoff can leach into groundwater and discharge to surface water, adversely affecting streams and wetlands. The impact and extent of these interactions depend on the chemical and physical nature of the pollutants (including contaminant mobility) and the hydrogeological conditions between the two water regimes. On-line databases provide free information to professionals engaged in stream and wetland restoration or cleanup of contaminated sites. These include GeoTracker (<http://geotracker.waterboards.ca.gov>), Envirostor (<http://www.envirostor.dtsc.ca.gov>), California Wetland Tracker (<http://www.wetlandtracker.org>), and the California Integrated Water Quality System (http://www.waterboards.ca.gov/water_issues/programs/ciwqs/publicreports.shtml). The Water Board has authorities under Section 401 of the Federal Clean Water Act and the Porter-Cologne Water Quality Control Act (California Water Code) to regulate discharges of fill into waters of the State. Many activities that involve streams or wetlands require a Water Board permit. Water Board staff have prepared A Primer on Stream and River Protection for the Regulator and Program Manager to guide applicants through the permit process. We developed a Rapid Permit Assessment Checklist to make it easier and faster to submit a clear and complete permit application. The draft Groundwater-Surface Water Interaction Checklist helps to determine if all potential sources of information for identifying groundwater-surface interaction at a site have been identified and reviewed.

Key Words - *Groundwater-surface water interaction; stream and wetland systems; site cleanup; stream and wetland restoration*

Theme: Watershed Management

Poster Board Number: 105. **Submission Number:** 73

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POSTER ABSTRACTS

San Francisco Bay Region Wetland and Riparian Base Map

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Management at the watershed scale for tracking changes in the extent and condition of aquatic habitat—as affected by projects, land use and climate change requires accurate and current baseline information of hydrological features and habitats. Federal datasets exist (National Wetland Inventory [NWI; USFWS] and National Hydrography Dataset [NHD; USGS]) that depict hydrological and habitat information at various resolutions. When applied in a local or regional context, these datasets fail to provide the comprehensive and sufficiently detailed information needed to guide management decisions. The San Francisco Estuary Institute is creating a new Base Map of aquatic habitat for the Bay Area as part of the Wetlands Regional Monitoring Program (www.wrmp.org). The Base Map will provide current and comprehensive data to local planners and managers and update federal datasets with high resolution information. The Base Map includes accurate representations of tidal flats, tidal marsh, streams, ditches, rivers, lakes, ponds, seasonal and perennial wetlands, and riparian areas. The information is captured through a combination of methodologies including; aerial photo interpretation, field work and landscape modeling. The mapping resolution exceeds existing standards and has undergone extensive internal quality control to meet regional and local needs. The Base Map is part of a larger initiative to extend proven, cost-effective wetlands assessment tools throughout the watersheds of the Bay Area. There are three types of tools in the wetlands assessment tool kit: Level 1 tools are landscape-level assessments using map inventories and analysis of landscape features; Level 2 tools are standardized, yet rapid, qualitative assessments of ambient conditions requiring only a moderate cost; Level 3 tools are intensive quantitative measurements of conditions, stressors, or cause-and-effect relationships and are more costly. The wetlands assessment tool kit will help environmental scientists, managers and the interested public identify opportunities for ecological restoration, floodplain management, and water supply reliability enhancements, improve our understanding of natural processes, and develop climate change adaptation strategies.

Key Words - *wetland; riparian; watershed management; mapping; hydrology;*

Theme: Watershed Management: Maps

Poster Board Number: 110. **Submission Number:** 223

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POSTER ABSTRACTS

New Creek & Watershed Maps of Morgan Hill & Gilroy and Oakland & Berkeley

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To educate and provide basic data to the public and professionals, Oakland Museum of California publishes a series of creek and watershed maps of the San Francisco Bay area. The latest two maps, published in 2009, are of the Morgan Hill and Gilroy area in southern Santa Clara County, and a new edition of the map depicting the Oakland & Berkeley area. Both maps feature detailed maps of the modern and historical drainage network on the front side, and regional maps and historical vignettes on the reverse side.

New on the reverse side of the Oakland & Berkeley map is a shaded relief map of the historical streams, wetlands, and marshes of the East Bay as they probably looked in the middle 1800s. Included are lands that drain to the eastern shore of the San Francisco Bay, from Carquinez Straight to Altamont Pass, and south to Mount Hamilton.

On the Morgan Hill & Gilroy map we present the story of Coyote Creek, which at times in the past flowed south to Monterey Bay instead of north to San Francisco Bay as it does today.

Key Words - *watershed Oakland Berkeley Morgan Hill Gilroy Creeks historical hydrology*

Theme: Watershed Management: Maps

Poster Board Number: 109. **Submission Number:** 256

Our Actions, Our Estuary
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POSTER ABSTRACTS

Concord Naval Weapons Station – Vegetation Community Mapping

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Due to relative inaccessibility, accurate vegetation community mapping in tidal marshes can be difficult to achieve quickly and cost effectively. However, monitoring changes in marsh communities and species composition can be essential to understanding the health of these systems. This study attempted to create a quick and inexpensive approach to mapping vegetation communities within a 200 acre tidal marsh in the Suisun Bay, Contra Costa County, California. Combining remote sensing, field verification, and geographic information systems, an initial vegetation community map was created in a pilot study in late summer 2005 and replicated in late summer 2008. Following ground level and helicopter surveys, WRA utilized eCognition Elements 4.0 software (Definiens Imaging) and a four band color-infrared aerial photograph with 6 inch resolution to interpret signatures of the plant communities. eCognition is a remote sensing application that utilizes a supervised segmentation process to interpret features within the image. Thousands of polygons were generated using this segmentation process. A few sample polygons were then selected to represent each vegetation community. After all samples were selected, eCognition was then allowed to classify the remaining polygons into the appropriate communities. This process was repeated 10 times until the classification accuracy was acceptable. This data was then exported into GIS (ArcGIS-ESRI) for analysis and map generation. Changes in the area of vegetation communities on the tidal marsh were readily identifiable, allowing for assertions to be forwarded accounting for the increase in communities dominated by saline tolerant and invasive species. The results of this vegetation mapping study indicated that these survey methods provided a reliable, repeatable, and cost effective way of detecting major landscape-scale changes in vegetation communities within tidal marshes.

Key Words - *GIS, vegetation mapping, remote sensing*

Theme: Watershed Management: Maps

Poster Board Number: 108. Submission Number: 210