

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

POSTER ABSTRACTS: Biological Species

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

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POSTER ABSTRACTS: Biological Species

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

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POSTER ABSTRACTS: Biological Species

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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POSTER ABSTRACTS: Biological Species

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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POSTER ABSTRACTS: Biological Species

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 photonicly-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

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, thicketail 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

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

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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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POSTER ABSTRACTS: Biological Species

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

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

Poster Board Number: 24. **Submission Number:** 195

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POSTER ABSTRACTS: Biological Species

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

Poster Board Number: 25. **Submission Number:** 262

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

Poster Board Number: 36. Submission Number: 248

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POSTER ABSTRACTS: Biological Species

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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POSTER ABSTRACTS: Biological Species

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

Poster Board Number: 27. Submission Number: 83

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) (*Epiplatyas 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

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POSTER ABSTRACTS: Biological Species

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 x 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

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

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

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Our Actions, Our Estuary
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POSTER ABSTRACTS: Biological Species

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

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POSTER ABSTRACTS: Biological Species

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

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

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

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