Poster Abstracts

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General Topics:

Adaptation and Resilience

Delta Conservancy Proposition 4 Grant Program

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The Delta Conservancy works collaboratively and in coordination with local communities, leading efforts to protect, enhance, and restore the Delta's economy, agriculture and working landscapes, and environment, for the benefit of the Delta region, its local communities, and the citizens of California. In November 2024, voters approved Proposition 4, the Safe Drinking Water, Wildfire Prevention, Drought Preparedness, and Clean Air Bond Act of 2024. Proposition 4 identifies $29 million for the Delta Conservancy "to reduce the risks of climate change impacts upon communities, fish and wildlife, and natural resources, and increase public access" (Section 93020). Bond language specifies that at least 40 percent of the bond funds available "shall be allocated for projects that provide meaningful and direct benefits to vulnerable populations or disadvantaged communities," with 10 percent allocated for projects benefitting severely disadvantaged communities (Section 90140); technical assistance is available for these groups. All proposed projects must be consistent with statewide priorities as identified in Proposition 4, the Delta Plan, the Delta Conservancy's 2022 Strategic Plan, as well as applicable recovery plans. The Delta Conservancy will distribute Proposition 4 funding evenly across three project categories: Nature Based Solutions, Community Enhancement, and Ecosystem Restoration and Climate Adaptation. To date, Delta Conservancy programs have provided approximately $132 million to support over 60 projects. The Delta Conservancy anticipates administering two grant cycles, as well as a small grants solicitation. This poster provides additional information about our Proposition 4 grant program.

Keywords: Grants, community, climate, environment, Nature-based Solutions, restoration, access

Poster Topic: Adaptation & Resilience

Operationalizing Equity in Nature-Based Coastal Adaptation: Assessing Practitioner Perspectives from the San Francisco Bay, California

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Coastal regions are faced with rising sea levels as well as other coastal hazards caused by climate change. As coastal areas begin adapting shorelines to present and future impacts, planners and land managers are increasingly encouraged to pursue nature-based coastal adaptation (NBCA) approaches as opposed to traditional gray infrastructure solutions. Recent policies also emphasize the importance of centering social equity and environmental justice in climate change adaptation initiatives, calling for increased community engagement and the prioritization of project work in disadvantaged communities. Though NBCA and equity-led approaches are growing more mainstream, to date, no empirical work has investigated how practitioners are currently framing and operationalizing concepts of equity in the burgeoning field of practice. Using an analytic of multiple framings of equity, this study describes how practitioners are currently addressing social equity in NBCA projects in the San Francisco Bay Area, a densely populated and highly urbanized estuary in Northern California. We conducted semi-structured interviews with 30 individuals involved in NBCA projects and planning work across the region, including representatives from government agencies, community-based organizations, and consulting groups. We found that practitioners are overwhelmingly focused on strategies to address distributive and procedural inequities. A minority of practitioners applied contextual, management, and Indigenous sovereignty frames of equity, which depend on larger structural shifts in governance, funding models, shoreline property regimes, and land repatriation and require more NBCA-specific approaches. This study demonstrates the importance of sustaining and increasing attention to multiple dimensions of equity in NBCA planning, particularly those that are currently underrepresented in practitioners' scopes. We argue for developing specific equity interventions that address the unique challenges of integrating nature into urban coastal adaptation and offer recommendations for practitioners seeking to better operationalize multiple frames of equity in NBCA.

Keywords: climate change adaptation, sea level rise, equity, coastal management, nature-based coastal adaptation, San Francisco Bay

Poster Topic: Adaptation & Resilience

Enhancing Resilience through Conventional and Nature-Based Solutions: A Flood Risk Reduction Strategy for an Urban Estuarine System in the Philippines

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Flooding in estuarine environments remains a persistent concern, particularly in urban areas where riverine and tidal influences converge. This study focuses on the Antiao River Estuarine Catchment in Catbalogan City, Philippines—an area increasingly vulnerable to both upstream runoff and coastal inundation. An integrated hydrologic-hydraulic modeling approach using HEC-HMS and HEC-RAS was employed to evaluate three flood mitigation scenarios: (1) a baseline "Do-Nothing" condition, (2) a structural strategy using full-protection dikes (FPD), and (3) a hybrid approach combining FPD with nature-based solutions (NBS), including upstream reforestation, midstream constructed wetlands, and downstream mangrove restoration.

Model validation showed strong agreement with national flood hazard datasets (DENR-MGB and DOST-NOAH) and empirical flow estimates, with deviations within ±15%, ensuring reliable simulation outputs. Under baseline conditions, flood depths exceeded 2.5 meters in downstream areas, where estuarine dynamics compounded fluvial flooding. The FPD scenario reduced flood extent but caused unintended increases in localized inundation, elevating peak water surface elevation (WSE) to 5.22 meters due to flow constriction and limited outflow.

In contrast, the hybrid FPD–NBS scenario provided more balanced and effective results. It lowered peak WSE to 3.03 meters and reduced flood depths by up to 2.0 meters. Spatially, upstream reforestation delayed runoff and moderated peak flows; constructed wetlands attenuated volumes and depths midstream; and mangrove buffers at the estuary reduced tidal surges and flow velocities, resulting in an average depth reduction of 1.5 meters. Beyond hydraulic benefits, NBS elements supported ecological restoration and improved adaptive capacity to climate variability.

This study demonstrates that integrating structural and nature-based interventions offers a scalable and sustainable approach to flood risk reduction in estuarine urban systems. Future work should incorporate cost-benefit analysis, assess performance under extreme climate events, and engage communities to ensure long-term viability.

Keywords: Nature-based solutions, Resilience, Sustainability, Hydrologic modeling, Flooding, Estuary

Poster Topic: Flood Management/Levees/Dams

Greening the Gray: Experimental Tests of Living Seawall Approaches to Renovating San Francisco's Seawall

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Renovation or replacement of existing gray infrastructure such as seawalls provides an opportunity to design habitat that may also promote the establishment and success of a greater diversity of species, including native species of conservation concern. Traditional modern seawalls tend to be smooth vertical structures that have no real analog in nature. While many species inhabit natural rocky shorelines, research from around the world indicates that only a subset of native rocky-shore species are able to inhabit seawalls. Even within this group, some species do not do as well as their counterparts on natural shores, with smaller body sizes, lower rates of reproduction, and lower genetic diversity. The San Francisco Living Seawall Pilot is an experiment aimed at providing design guidance for the Port of San Francisco's Embarcadero Seawall renovation to enhance the habitat value of the renovated seawall for the Bay ecosystem.

The project examines ways to modify traditional seawall structure and topography to enhance ecological community diversity and function. At each of three elevations at three sites chosen for the project, concrete test tiles of different materials and texture were mounted on steel frames attached to the existing seawall. The microclimates on the tiles and the communities inhabiting the tiles will be monitored for at several years to evaluate community development on the different tile types. Ultimately the results will be combined with separate engineering requirements to address seismic safety and sea level rise.

Here, we present preliminary results from the first two years of the experiment showing differences in species richness and composition across elevations and sites, and examine the prevalence of the native Olympia oyster, a species of conservation concern in the Bay.

Keywords: living seawall, infrastructure, oysters, sea level rise, biodiversity

Poster Topic: Adaptation & Resilience

Living Breakwaters in SF Bay

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The shoreline of San Francisco Bay has been greatly altered over time. The traditional approach to protecting shorelines from erosion has been armoring with rip rap. However, rip rap does not provide good opportunities for native habitats to become established. We will analyze the design of living breakwaters as an more environmentally friendly solution to shoreline protection. We will summarize the design of these features and their benefits.

Keywords: living shorelines, nearshore breakwaters, living breakwaters, islands, oysters, deposition, accretion

Poster Topic: Adaptation & Resilience

Advancing Collaborative Science

Assessing the Impact of Delta Science Program Funded Research on Decision Making in the Delta

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The mission of the Delta Science Program (DSP) is to provide the best possible unbiased scientific information to inform water and environmental decision-making in the Delta. One avenue to achieve this mission is to fund research that aids in decision-making in the Sacramento-San Joaquin Delta (Delta). However, how DSP-funded science impacts decision making in the Delta is currently not well defined. Therefore, we are utilizing research impact assessment (RIA) framework to assess the impacts of the DSP-funded research, beginning with the 2019 Delta Research Awards and 2020 Delta Science Fellows, as it commonly takes up to nine years for management and policy impacts to arise from research. RIA is similar to assessing return on investment, but instead of assessing financial returns of funded research we instead focus on broader societal benefits of funded research. While there is no single process or checklist for evaluating research impact, one established method is to utilize a logic model to break down the impact process. To do this, we defined a logic model that outlines inputs, activities, outputs, outcomes, and impacts of DSP-funded research. For each step of the logic model, we identified key metrics that measure progress towards impact in the Delta. For example, for each project we tracked the money allocated, scientists funded, institutional affiliation, project topic, presentations, publications, reports, earned media, broader impacts, whether the funded research influenced Delta restoration projects or legislation, and more. Overall, we believe that the RIA framework allows the DSP to track the ultimate impacts of funded research and demonstrate the DSP's benefits to the Delta. Measuring the impact of DSP-funded research will not only document the benefits of funding research but will also help the DSP to adaptively manage funding solicitations to maximize impacts to the Delta in the future.

Keywords: Research Impact Assessment, Research Impact, Delta, Decision-Making

Poster Topic: Science Communications

Science Action Agenda Snapshot Progress Summary

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The Science Action Agenda (SAA) prioritizes and aligns science actions to fill gaps in knowledge in the Sacramento-San Joaquin Delta (Delta) and achieve key objectives in the Delta Science Plan. Science Actions in the SAA were collaboratively developed with the Delta science community and are intended to address today's management questions, challenges on the horizon, and anticipated long-term science needs. We developed the SAA Snapshot Progress Summary (Snapshot) to highlight progress made to date on implementing the 2022-2026 SAA.

For the Snapshot, we reviewed projects funded by the Delta Stewardship Council (Council) and State Water Contractors (SWC) which, in their solicitations, required that projects address the SAA. The Snapshot evaluated which Science Actions have been addressed, the number of projects addressing each Science Action, and how much funding has been invested in the 2022-2026 SAA. The scope of the Snapshot was limited to projects funded by the SWC and Council to project a quick glimpse of progress directly contributing to the SAA.

Our main findings show that ~$16M has been allocated to implementation of the 2022-2026 SAA. Of the 25 priority Science Actions in the SAA, 22 are being addressed by 38 different projects funded since 2022. Many of these projects are in the initial/ ongoing phases, indicating that progress of SAA implementation is still in the early stages and will be summarized later in a full 2022-2026 SAA Progress Summary.

The Snapshot findings are intended to be used to shape future funding solicitations and implementation of the 2022-2026 SAA. Results demonstrate the importance of funding science to advance ecosystem and social sustainability and the remaining gaps. We urge the Delta science community to leverage resources to address the Science Actions not yet addressed and invite the community to track progress of the existing projects in the Delta Science Tracker.

Keywords: science action agenda, science funding, community

Poster Topic: Science Communications

Delta Stewardship Council update to the Delta Science Plan

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The Sacramento-San Joaquin Delta is a complex socio-ecological system, reshaped by over a century of human-driven modifications to convey water across the state. In alignment with the coequal goals of the Delta Reform Act—to ensure a more reliable water supply for California and to protect, restore, and enhance the Delta ecosystem—the Delta Stewardship Council, in collaboration with the Delta science community, has updated the Delta Science Plan. This update is structured around four Grand Challenges facing the Delta; inspired by the National Research Council's Grand Challenges in Enviromental Science. Grand Challenge #1: Scientists and managers must anticipate a world in which environmental conditions and regulations may be fundamentally different from those faced today. Grand Challenge #2: Environmental change is outpacing the traditional pace of science. Grand Challenge #3: Flows of scientific information remain decentralized and poorly connected to communities and decision-makers. Grand Challenge #4: Other ways of knowing, especially Traditional Knowledge, remain siloed from decision-making. To involve the broader Delta community, the four Grand Challenges were released for public comment in summer 2024 and the Delta Science Program hosted a two-day workshop in February 2025 to receive feedback. A total of 99 participants attended the workshop, resulting in 533 individual comments that were considered for the update. In addition to the core content, the appendices, which have been identified by the Delta community as highly useful and valuable, have been updated. In response to community feedback, three appendices were removed, nine updated, and two new ones (Data Governance, Portals, and Online Resources; and Social Science Integration to Natural Science Workflows) were added. Continuing the commitment to an open, transparent, and inclusive process, the draft Delta Science Plan has a planned release for public comment in Fall 2025, and we welcome community feedback to help shape its final form.

Keywords: Sacramento-San Joaquin Delta, socio-ecological systems, science plan, Delta Stewardship Council

Poster Topic: Watershed Management

Launching a Regional Climate Science Consortium

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Climate adaptation planning across the San Francisco Estuary region increasingly calls for science-informed decisions, especially as nature-based solutions gain traction. However, no single entity currently exists to consistently convene scientific expertise, synthesize emerging knowledge, and translate it into guidance usable by planners, regulators, and communities. This gap slows project planning and development and limits regional alignment in addressing sea-level rise and shoreline resilience. The newly launched San Francisco Bay Regional Climate Science Consortium addresses this gap by creating a regional hub for climate adaptation science. Based at the Estuary & Ocean Science Center, the Consortium brings together scientists, agency staff, and practitioners to collaboratively identify science needs and synthesize actionable knowledge. The pilot effort is focusing on two shoreline adaptation strategies; sediment manipulation in and along wetlands, and habitat enhancements for hard structure along urbanized estuary edges. So far, we have convened a steering committee and hired core staff, contributing scientists, and a program effectiveness consultant. Through regular working sessions, the team will identify key knowledge gaps, distill lessons from local and global examples, and produce practical guidance for the region. The Consortium will deliver a suite of products to accelerate and align regional adaptation efforts: (1) white papers on each of the two focus strategies; (2) a peer-reviewed publication highlighting the development and structure of the Consortium, lessons learned, and its outputs; and (3) an inaugural State of Adaptation Science workshop to share findings, gather feedback, and shape future priorities. By integrating science and practice, the Consortium supports ecosystem resilience and offers a model for embedding science into climate action across the Estuary.

Keywords: Climate science, Sea-level rise, Adaptation, Science-practice gap

Poster Topic: Climate Change

Laying the foundation for a Delta Modeling Collaboratory: A project-based collaborative modeling approach to complex management challenges

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The Delta is a complex social-ecological system subject to a range of interacting environmental and social drivers (e.g., precipitation, tides, climate change; and agriculture, reservoir and pumping operations, urban water). This complex system requires assembling and interpreting vast amounts of data using techniques such as modeling, synthesis science, and decision-support tools. Many models are already in use in the Delta for predicting and managing everything from hydrology to fish migration. In 2025, the Delta Science Program launched three projects to assess the feasibility and efficacy of applying an integrated modeling approach to three important management themes: 1) predicting cyanobacterial harmful algal blooms (CHABs); 2) evaluating salinity intrusion and associated management actions; and 3) restoring tidal wetland food webs. For each of the three projects, diverse teams of participants created project "profiles" that identify potential modeling approaches, existing resources that could be leveraged, and critical resources that are currently lacking. These profiles also outline how their approaches and resources would lead to key project outcomes, such as modeled potential future scenarios and communication products like Shiny apps and academic papers. Furthermore, the profiles specify the relevant interested parties to engage further. Operating the three projects in parallel provided unique benefits by highlighting synergies between projects, facilitating resource sharing, and allowing for the prioritization of activities that support multiple initiatives. But this approach not only generates benefits from—and for—each individual project, it also lays the foundation for development of the Delta Modeling Collaboratory, a networked community of modelers and modeling resources to support integrated modeling projects. The vision of the Collaboratory is grounded in establishing a support structure centered on collaboration and resource sharing.

Keywords: Delta, decision-making, data, modeling, water, socio-economic, environmental, harmful algal blooms, food webs, salinity

Poster Topic: Data/Tools

Climate Change

Extreme climates modify aquatic macroinvertebrate community's responses to environmental variability

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Climate change has intensified the frequency and severity of extreme weather events over recent decades. In California, prolonged droughts have begun to reshape how aquatic communities respond to environmental variability, though the extent of this shift remains poorly understood. We investigated long-term changes in macroinvertebrate communities in Suisun Marsh by comparing abundance data and environmental conditions from dry years (2015, 2021) and wet years (2012, 2018) over the past two decades. Using Bayesian structural causal modeling, we quantified the influence of macrophyte cover and water quality parameters on macroinvertebrate abundance. Our findings indicate that emergent macrophyte coverage significantly reduces macroinvertebrate abundance, with the negative effect being 1.4 times stronger during dry years compared to wet years. Additionally, the influence of environmental drivers on macroinvertebrate communities varied across taxa and years. For example, elevated water temperatures increased the abundance of freshwater clams during dry years but had the opposite effect during wet years. Warm conditions also strongly promoted the abundance of saltwater clams and black sea jellyfish, particularly in drought conditions. Our findings highlight the complex and taxon-specific responses of estuarine invertebrate communities to changing hydrological regimes, underscoring the importance of incorporating climate-driven variability into estuarine management and conservation strategies.

Keywords: invertebrates, tidal wetland, aquatic plants, back-door criterion, causal inference

Poster Topic: Climate Change

Effects of ocean acidification and nutrient additions on invasive amphipod herbivory of eelgrass in San Francisco Bay

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Seagrasses provide valuable ecosystem functions, yet they are declining globally due to environmental and anthropogenic stressors. To understand how stressors influence seagrass habitats, it is essential to test how global climate stressors like ocean acidification interact with local environmental conditions (e.g. increased nutrient pollution) to affect ecosystem functions and trophic relationships. In San Francisco Bay, it is unknown how stressor interactions will affect the feeding behavior of *Ampithoe valida*, an invasive and abundant amphipod that exhibits novel feeding behavior by directly consuming the tissue of *Zostera marina* (eelgrass), a behavior not observed in other estuaries. To further understand this trophic relationship, this study first examined *A. valida* food preferences to varying ages of eelgrass and epiphytic algae across various sizes of *A. valida*. Secondly, *A. valida* and eelgrass were exposed to levels of ocean acidification expected with accelerating climate change, combined with levels of nutrient pollution observed along populated coastlines, to test if these combined stressors affect *A. valida* herbivory of eelgrass. Preliminary results suggest that *A. valida* size influences feeding behavior, with larger individuals grazing on both epiphytic algae and eelgrass tissue, while smaller individuals feed on epiphytic algae. Additionally, exposure to stressors may alter *A. valida* herbivory of eelgrass, with reduced pH conditions increasing *A. valida* eelgrass consumption. These findings suggest that future environmental stressors could impact *A. valida* feeding patterns, with implications for effective eelgrass conservation and restoration in San Francisco Bay.

Keywords: Eelgrass, Climate Change, Invasive Species, Ocean Acidification, Nutrient Pollution, Ecological Restoration

Poster Topic: Climate Change

Can An Eelgrass Dominated Bay Ameliorate Acidification In An Urban Estuary?

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Eelgrass beds are vital nursery habitats for many ecologically and commercially important species, including Dungeness crab, Pacific herring, and native Olympia oysters - all of which are sensitive to ocean acidification. Recent studies suggest that eelgrass beds may help buffer the effects of acidification due to their ability to alter water chemistry and raise pH through photosynthetic activity. This buffering potential could be especially valuable in the San Francisco Estuary (SFE), an urbanized estuary exposed to acidification from greenhouse gas emissions, poorly buffered coastal watersheds, high nutrient and carbon loading, and periodic intrusions of CO_2-rich upwelled waters. We hypothesized that eelgrass beds in the SFE would be autotrophic dominant and thus less vulnerable to acidification, maintaining higher pH levels than unvegetated areas. To test this, we analyzed long-term water quality data and conducted field sampling to compare seasonal and diurnal trends in pH between an established eelgrass bed in Richardson Bay and a deep, unvegetated channel in the SFE. Our findings show that biological activity was the main driver of water chemistry changes within the eelgrass habitat, whereas its influence was minimal in the deep channel. Seasonally, pH at both sites ranged from 7.70 to 8.00, but the eelgrass bed reached as high as 9.00 during spring and even in winter, outside the main growth season. Diurnal pH in the eelgrass habitat ranged from 7.81 to 8.17, indicating strong autotrophic dominance throughout the day and night. In contrast, the deep channel exhibited relatively stable pH values between 7.80 and 7.89. These results suggest that eelgrass beds can play a significant role in mitigating ocean acidification in urban estuaries like the SFE. Future research should investigate whether restored eelgrass habitats provide similar buffering benefits, informing conservation and restoration efforts.

Keywords: Eelgrass, Acidification, Buffer, Upwelling, Urbanization, Zostera Marina, Restoration, Dungeness crab, Carbonate Chemistry, Estuary

Poster Topic: Climate Change

Community Engagement and Science

Blooming Plankton of Lake Merritt, Oakland CA

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Phytoplankton form the basis of marine food webs and through photosynthesis release oxygen to the atmosphere and into aquatic ecosystems where it fuels cellular respiration that most life forms depend on. In Oakland California, a phytoplankton species, *Heterosigma akashiwo*, entered the estuarine "lake" in August 2022 via the Lake Merritt Channel as part of a spreading East San Francisco Bay bloom. Within days, the explosive phytoplankton bloom (HAB) expired. However, ensuing bacterial decay caused dissolved oxygen in the lake to plummet to near zero. This resulted in an unprecedented highly publicized massive fish kill in the heart of a major city. The microscopic life of Lake Merritt has been studied scientifically for well over a century; however, the public paid little attention until now. A local nonprofit, Rotary Nature Center Friends at Lake Merritt, collected and archived microscope images of plankton in the field since 2021. We participated in two governmental plankton monitoring programs which provided professional assessments of the species present in the samples we collected: a SFRWQB EPA grant funded program and the CDPH Redtide program. Our examination of fresh plankton added to the picture of changing plankton populations in the lake. Young people participated in carrying out the protocols for collection and sending samples to professional labs. They also helped to view and collect images of fresh plankton.Our results indicate that plankton populations change often in the lake. In addition to the August 2022 HAB, in the first quarter of 2023, at least three "blooms" were dominated by one type of phytoplankton. By providing young people with authentic experiences using microscopy and participating in real scientific monitoring we inspire the next generation of environmental researchers and stewardship professionals.

Keywords: Lake Merritt, HAB, Dissolved Oxygen, Community Monitoring, plankton,

Poster Topic: Community Engagement

Tracking Aquatic Invertebrates in an Urbanized Estuary - Keeping an Eye on Oakland's Lake Merritt in 2022-2023

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Lake Merritt is a brackish water tidal estuary in Oakland CA. From 1962-1972, James Carlton carried out detailed studies of its marine and estuarine life providing an extensive description of species and communities present at that time. A re-survey of the lake was conducted in 2016 by James Carlton of Williams College MA and Andrew Chang of the Smithsonian Environmental Research Center (SERC) Tiburon CA, and an additional SERC team, to see how the lake communities had changed in 50 years. They reported shifts in community composition, new non-native species, and a notable increase in species common to higher salinity environments. Recently, Lake Merritt has been subjected to 1) a harmful algal bloom (HAB) that decimated fish and many invertebrate populations and 2) a historic series of atmospheric river events causing prolonged freshening and shoreline flooding. The detailed scientific surveys provided by Drs. Carlton and Chang provide a baseline from which to view changes occurring after these recent ecological catastrophes.
Rotary Nature Center Friends, an educational non-profit, has involved the local community – local students (K-college, public and private) and interested adults of all ages - in recording the presence of invertebrates on the iNaturalist platform. We were making observations, as part of a public outreach event on the day of the fish kill.
Since October 2022, we continue to track invertebrate species at Lake Merritt under a broad citizen-science umbrella: an iNaturalist project, Harmful Algal Bloom in Lake Merritt: Are there any survivors?, California Academy of Sciences sponsored City Nature Challenge and Snapshot CalCoast events and Biodiversity Days. Preliminary results indicate that recovery of ecological communities in the lake has been surprisingly quick but uneven. We have recruited iNaturalist enthusiasts among teens and college students, an under-represented demographic, and encouraged the next generation of naturalists, nature-lovers, and science professionals.

Keywords: Dock Fouling, Aquatic Invertebrates, Salinity, Dissolved Oxygen, Oakland, Lake Merritt, Estuary

Poster Topic: Community Science/Volunteer Monitoring

Lake Merritt Underwater - Views Before and After Environmental Catastrophes

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Lake Merritt, a tidal estuary in highly urbanized Oakland California, has suffered from poor water quality and trash pollution since colonial times. Recently, the threat of harmful algal blooms and extreme weather related to climate change has introduced new challenges. Programs to engage the public in both the science and the conservation measures needed to address the underlying problems remain limited. In 2018 we established an informal environmental education program called the Lake Merritt Underwater Observatory (LMUO) to connect people who visit Lakeside Park at Lake Merritt to the living communities normally out of view. We acquired a Trident ROV (remotely operated vehicle) that recorded underwater video footage and could be operated by students and casual visitors. We were able to continue our program safely through the pandemic. We acquired videos of underwater life nearshore and in deep water in different parts of the lake in different seasons. Here we focus on videos collected before and after two environmental catastrophes: August 2022, the harmful phytoplankton species *Heterosigma akashiwo* entered the estuary from San Francisco Bay causing a 5-day anoxic condition at both top and bottom of the water column. An unprecedented fish kill seen on the shoreline was national news and spurred city action and new management plans. In January 2023, a series of atmospheric rivers hit Oakland causing rapid freshening of the almost marine lake and flooding of shore habitats. We involved community college, K-8 classes and groups and adults visiting the lake for recreation in viewing the devastation of invertebrate and plant communities immediately following both events and the uneven return of species in the year that followed. We hope the experience will inspire youth to pursue environmental and technology careers in the future.

Keywords: Lake Merritt, Trident ROV, Community Science, Atmospheric Rivers, Harmful Algal Bloom, Fish Kill, Heterosigma akashiwo, HAB, environmental education

Poster Topic: Community Engagement

The Waters of Lake Merritt, Oakland, California

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The history of water in Lake Merritt is complex involving geology, oceanography, biology, and humans. During the Pleistocene, sea levels were lower than at present level. San Francisco Bay then was a river valley and Merritt Canyon, future site of Lake Merritt, was a streambed. About 125,000 years ago, the sea rose to 8 m higher than it is now. From 13,000 to 4,000 years ago, sea level rose again from 120m to its present height. The shoreline 13,000 years ago lay 50 km off the Golden Gate and people migrated south along the coast. As sea level rose, it reached the Golden Gate ~8,000 years ago. The sea filled SF Bay and the mouth of Merritt Canyon creating San Antonio Slough with tidal mudflats and marshes. Ohlone people occupied the bay area and lived near the San Antonio Slough. They built six shell mounds near the slough. In 1770, Spanish arrived, built missions, and forced the Ohlone into them. After the Mexican American War in 1848 and gold discovery, Americans and others rushed east to the mountains. Most found nothing and some returned to Oakland. Americans built homes around the slough. The city dumped sewage into the slough that already smelled bad due to it's mud and marshes. Mayor Samuel Merritt dammed the channel in1868, so water flooded the slough at high tide and was retained at low tide, thus creating an estuarine lake, soon called Merritt's Lake and later Lake Merritt. Birds were hunted along the shore causing damage to homes--Merritt had the state legislature declare Lake Merritt a nature reserve, the first in the nation. The lake has since developed into a pleasant feature of Oakland. Future sea level rise is expected to inundate the lake and surrounding land.

Keywords: water, Lake Merritt, sea levels, slough,

Poster Topic: Adaptation & Resilience

Chinook Salmon Occurrences in Lake Merritt, Oakland, California, from 2021 to 2025

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Anadromous adult Chinook salmon (*Oncorhynchus tshawytscha*) appeared recently in Lake Merritt in Oakland, California on their final journey from the ocean to fresh water. Carcasses were monitored by a volunteer organization through a CA Department of Fish and Wildlife Scientific Use Permit. The lake is capable of supporting a broad diversity of fish, but most of the salmon entering the lake soon died, most likely as a result of their semelparous life cycle. The carcasses recovered from the lake were mostly males with a ratio of 2 males/1 female. Some individuals had spots on the lower lobe of the caudal fin (an identification character of chinooks), while others had no spots. Of the 30 specimens recovered from the lake during the 2024-2025 season, 5 were hatchery-raised as determined by the clipped adipose fin. Only 25% of fish from hatcheries are fin-clipped, suggesting that approximately 20 of the 2024-2025 Lake Merritt fish are hatchery-raised. Where did the other fish come from? Rotary Nature Center Friends is pursuing answers to this question. We are having coded wire tags read and, potentially, isotope analysis of the ear bones (otoliths) of unclipped fish. The ratio of strontium isotopes can indicate the stream of origin, if the water from that stream has been analyzed.

Keywords: Chinook Salmon, urban estuary, community scince, monitoring, Oakland, anadromous, otolith, coded wire tag

Poster Topic: Community Science/Volunteer Monitoring

Dissolved Oxygen in an Urban Tidal Estuary - Oakland CA's Lake Merritt 2022-2025

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Lake Merritt is a brackish water tidal estuary in the center of Oakland CA. It has long suffered from low water quality and was declared an “impaired body of water” by the U.S. E.P.A. in 1997 due to low dissolved oxygen (DO) and trash. Water quality has improved in subsequent years through city and regional programs to reduce trash and employ green infrastructure to deal with runoff. In August 2022, Lake Merritt suffered a catastrophic fish kill caused by a Harmful Algal Bloom (HAB) of the phytoplankton species *Heterosigma akashiwo*. DO plummeted to near zero at both the top and bottom of the water column. In order to understand the conditions that might spark a HAB and possibly predict a recurrence, Oakland Public Works, with the help of Laketech.com and the Lake Merritt Institute installed water quality monitoring buoys that provided 24/7 monitoring of DO, temperature, salinity, chlorophyll and turbidity.
Our project addressed the need for additional information about spatial variation and seasonal DO changes at mid-lake and near the shore stations. It addressed the benefits of involving the local community, especially youth, in the science of stewardship of the lake, encouraging participants to pursue science and technology careers.
We used a calibrated sonde to measure water quality parameters at mid-lake and shore stations from August 2022 to the present.
We found that:
Dissolved oxygen varied with location along the shore as well as with depth in mid-lake.
During daytime hours of monitoring, the water quality objective of 5 parts per million dissolved oxygen was nearly always met.
Dissolved oxygen did not approach zero at both the top and the bottom of the water column during our monitoring.
We conclude that community monitoring can contribute to understanding the conditions surrounding HABs and benefit community and youth development.

Keywords: Lake Merritt, HAB, Dissolved Oxygen, Community Monitoring

Poster Topic: Community Science/Volunteer Monitoring

California Naturalist Certification Courses: Providing Equitable Access to Nature and Stewardship for the Generations of Naturalists to Come

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California Naturalist Certification Courses, offered throughout the state, graduate trained volunteer educators that engage people in the enjoyment of nature, invite curiosity and a quest for deeper understanding of the natural processes and cycles that affect our lives. They promote scientific understanding that can inform stewardship choices we make as citizens.

Each UC Naturalist Certification Course provides 40 hours of instruction: science-based curriculum, field experiences and training in communication skills and stewardship. Each emphasizes the unique ecology of a particular location in California. The program is committed to equitable access to everyone in the community. Scholarships are often offered to participants with need. The benefits to the community are increased engagement of the public in enjoyment and stewardship of the environment. The benefits to participants in courses are new skills and networking as well as enhanced enjoyment of nature and the community.

This poster will introduce the University of California Naturalist Certification program (https://ucanr.edu/statewide-program/uc-environmental-stewards/become-certified-naturalist-or-climate-steward) from the perspective of a new program partner at Lake Merritt offering a naturalist certification course in Urban Estuaries for the first time this fall. It will also reach out to other UC Naturalist Certification courses that are offered in the San Francisco Bay Area to share their program details and the unique features of California's diverse habitats and communities they emphasize.

Keywords: stewardship, natural history, naturalist, ecology

Poster Topic: Community Engagement

Scout's Adventure to Coyote Creek: Connecting K–5 Students to Nature through On-Campus Performance Art

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Scout's Adventure to Coyote Creek was developed to bring the vibrant biodiversity of Coyote Creek directly to K–5 classrooms, especially targeting schools with limited access to natural spaces as identified in CalEnviroScreen research. Coyote Creek borders the Alum Rock Union and East Side Union School Districts—communities that are predominantly Hispanic or Latino (73.4%) and socioeconomically disadvantaged (79.3%), with many English learners (41.2%) and students with disabilities (16%). Youth in these areas often face barriers to accessing nature and are at increased risk for negative health outcomes. Scout's Adventure helps bridge this gap by bringing nature to them. This interactive, NGSS-aligned educational program engages students with a performance-based, multi-sensory experience designed to spark curiosity, foster environmental awareness, and promote local stewardship. The program's iterative development process was guided by NGSS standards and shaped through ongoing adaptation for grade levels, attention spans, accessibility, and outreach challenges. Students explore local flora and fauna through recycled-material animal models, hear nature sounds, and participate in kinesthetic learning like the Water Cycle Dance and the 4-R Dance (Reduce, Reuse, Recycle, Refuse) — making learning engaging and memorable. Feedback from both teachers and students highlights the program's impact. One student's remark — "You have to put that in the garbage because the Acorn Woodpecker shouldn't eat it!" — reflects the powerful environmental awareness fostered by the program. Scout's Adventure not only supports academic content but instills a lasting sense of responsibility toward the local ecosystem, showing that even young children can begin to think like environmental stewards when given meaningful, accessible educational experiences.

Keywords: Environmental education, Multi-sensory education, Urban youth engagement, Stewardship, NGSS-aligned curriculum, Environmental justice, K-5 education, Creek habitat exploration, Watershed appreciation

Poster Topic: Public Education, Outreach, and Access

Participatory Science Networks for a Trash-Free SF Bay

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This poster presentation will be led by east bay high school interns who, along with local non-profits and public universities, form a participatory science network (PSN) doing trash monitoring in the regulatory context of the SF Bay Municipal Regional Stormwater Permit (MRP). With funding from USEPA Region 9's SF Bay Water Quality Improvement Fund, our project advances participatory methods with four MRP permittees (city governments) facing composite burdens of high trash loading rates, particularly in underserved communities, along with monitoring, infrastructural and other management challenges. Our PSN engages the expertise of educational nonprofits, university scientists and stormwater practitioners to produce regulatory-quality trash monitoring data while providing community members with meaningful engagement and career training. For example, interns collect and manage data through the Trash Rapid Assessment Data Exchange (TRADE), a previous EPA-funded project designed to support community-based monitoring within California's NPDES program. Our current two-year project, now halfway through, will result in at least: 160 on-land, itemized and visual trash assessments (OVTAs) with app-based surveys that feed quality-assured data to permittee partners; 9,600 gallons of trash removed from local communities and prevented from flowing to the Bay; 120 local internships focused on STEM skills and workforce development; and 960 hours of community participation in trash removal and education. Because these outcomes address SF Estuary Blueprint Goals 2, 3 and 4, this project can serve as a model for expanding participatory science approaches to trash and other pollutant monitoring around the SF Bay.

Keywords: Participatory science, water quality, trash, litter, municipal regional permit, NPDES,

Poster Topic: Community Science/Volunteer Monitoring

Can citizen scientists determine the Bay Area stream type of local creeks using a smartphone app?

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A stream classification is a system that organizes streams into categories based on a general set of characteristics that differentiate among them. It can help environmental managers set expectations about ecological functions, societal uses, natural hazards, and restoration strategies for an individual stream site based on the group it is part of. Recently, a stream classification was produced for the 9-county San Francisco Bay Area that has 12 types (6 artificial sub-types and 6 natural sub-types). We hypothesize that citizen scientists and professionals may be interested in determining a site's stream type in the new system, and add it to the database. To resolve this, we tested out a phone-based survey app that involved a binary key designed with the goal of helping streamline the process of data collection for regional stream typing. To test its effectiveness, we used the app to collect survey data at river sites across the SF Bay region. Some sites were locations with known stream type from prior quantitative, expert determination. These were used to evaluate our performance in visual stream typing without any measurements. Other sites were observed to characterize the abundance and distribution of stream types in the region and train a machine learning model that will predict stream types for all unobserved locations. By the end of the study, we aim to have gathered and organized a wide range of survey data to help understand and manage the region's streams.

Keywords: Citizen Science. Stream Classification. Rivers

Poster Topic: Community Science/Volunteer Monitoring

Degradation of Baylands Ecological Density and Flood Risk in the San Francisco Bay: A UAS-Based Study

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Across the Don Edwards range in the San Francisco Bay Area, we observe increasing ecological decay, revealed by data from aerial surveys using unmanned aerial systems (UAS). These surveys highlight a deeper issue: the impact of urban sprawl and industrial development. The degradation of bayland ecological density has increased the region's susceptibility to flooding. This study quantifies the relationship between ecological density and flood vulnerability using high-resolution UAS surveys.

To study this decay, we flew a DJI drone over more than 500 acres, highlighting critical points in the South Baylands near the Coyote Lagoon area. Using the DroneDeploy application, we processed the aerial images with 99.7% success rate, producing an orthomosaic with a 9.4 cm ground-sampling distance and a 46,300,588-point dense cloud (94 million points/km^2). Spatial accuracy was quantified (CE90 = 3.04 m; LE90 = 0.81 m; GPS RMS error = 2.02 m; 3D RMS error = 0.36 m). Pixels were classified as vegetated or barren using VARI (Visible Atmospherically Resistant Index) threshold validated by ground photographs. The degradation in ecological species density was assessed through this image processing.

Reduced plant coverage increases flood risk in the Bay, making the broader San Francisco metropolitan area more vulnerable to environmental damage. Diminished biomass reduces surface roughness and sediment trapping, potentially increasing near-shore wave heights by 12% during 10-year storm events, further compounding the flood threat to nearby communities. Flood-model sensitivity analysis indicates these degraded zones could experience up to 0.15 m additional inundation under baseline sea-level rise scenarios.

Our unified low-cost UAS workflows enable annual monitoring of bayland recovery and prioritization of restoration sites. Rapid, high-accuracy mapping can inform flood mitigation planning and community resiliency efforts. Involving student teams in scalable drone missions will support long-term Baylands conservation and policy advocacy.

Keywords: Drones, UAS, Orthomosaic mapping, Ecological density, Don Edwards, Youth, Flood Risk, FAA Part 107 Certified Pilot

Poster Topic: Community Science/Volunteer Monitoring

Women+ of Wildlife Annual Resource Retreat: A Case Study on the Importance of Dedicated Spaces for Marginalized Groups in Wildlife

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Wildlife conservation, historically a white male dominated field, has in recent years shifted demographically. At the early career level Women are now the majority, but the perspectives and logistics of the field have not caught up with this shift. During a virtual Western Section Women of Wildlife mixer in 2021 it became clear that there was a need for a dedicated event or space where the Women+ of the section could gather and address their needs and challenges. In response the Western Section of TWS has hosted a Resource Retreat for Women+ of Wildlife annually for the past four years which has been targeted at women, femme identifying individuals and non-binary people. These events have been different each year, and they keep improving! They include a mix of professional development presentations, practical workshops (e.g., self-defense), self care, group problem solving, and other professional-facing activities. But just as importantly, there are also multiple components each year that focus on fellowship, sharing challenges and grievances, peer support and resources, and just plain old fun! With games, karaoke, shared meals, and more, this event is also just a chance to connect with other Women+ and make new friends. What has resulted is a new community where Women are supported by other Women as well as similar events being hosted at the local level. Participants have reported extremely positive experiences. The importance of events like this cannot be overstated and should be provided for all marginalized groups within wildlife organizations (e.g, LGBTQAI, BIPOC). This group of individuals post-retreat have kept in contact and has allowed them to begin research at UC Reserves, contribute their work research in conferences and connect like-minded individuals.

Keywords: BIPOC, LGBTQAI, empowerment, research, professional, growth, networking, breaking barriers, opportunities

Poster Topic: Community Engagement

Data/Tools

Marsh phenology from remote sensing: multi-scale indicators for wetland functions and change

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Phenology, or seasonality of ecosystems holds important clues on how their key functions and services respond to local and global change drivers. Landscape phenological patterns can be increasingly monitored with the help of growing archives of remote sensing products and their improving spatial and temporal detail. However, this potential remains under-utilized in wetlands despite the critical need for non-invasive, cost-effective monitoring indicators. Here we discuss the potential of remotely sensed phenology to indicate gross primary productivity (GPP) and post-restoration transformation of vegetation structure and function in wetlands of the San Francisco Bay, Suisun Marsh, and Sacramento-San Joaquin Delta. We show how temporally dense archives of high spatial resolution optical satellite imagery (10m and under) can elucidate variation in plant canopy structure and GPP even in the absence of detailed information on 3-D canopy configuration. We also discuss the potential of new open-access satellite lidar and radar products to supplement optical phenology assessments and provide holistic site-level insights on post-restoration ecosystem and habitat change. These insights can help support and expand regional wetland monitoring efforts and contribute to emerging portfolios of change indicators for current and future applications.

Keywords: Remote sensing, wetlands, marshes, restoration, landscape change, monitoring, indicators

Poster Topic: Data/Tools

Building a Process-Based Biogeochemical Model to Improve Net Ecosystem Carbon Balance Estimates in Tidal Wetlands

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Tidal wetlands are a valuable nature-based climate solution in the face of increasing anthropogenic carbon emissions, having both high carbon sequestration potential as well as significant ecological value. Existing research on carbon cycling in tidal wetlands focuses primarily on wetland-atmosphere carbon exchanges and carbon captured in wetland soils. More research is needed on the lateral exchange of carbon between tidal wetlands and the coastal ocean to better understand the effects of wetlands on the carbon cycle, including downstream impacts on coastal waters in the San Francisco Estuary. Co-located, coupled measurements of atmospheric and lateral carbon fluxes lead to more accurate net ecosystem carbon balances (NECBs), which are the net total carbon inputs and outputs within a system. These data can improve process-based models, which can be used to assess the true climate mitigation potential of tidal wetlands at larger spatial scales. We built a process-based model (Peatland Ecosystem Respiration and Methane Transport - Lateral Flux, "PEPRMT-LF") using in-situ flux measurements at Mt. Eden Creek Marsh, a restored tidal wetland in the South San Francisco Bay, CA. The model predicts lateral flux by simulating dissolved inorganic carbon (DIC) production through sulfate and nitrate reduction via Michaelis-Menten enzyme kinetics, where carbon, sulfate and nitrate availability influence rates of reaction. DIC transport is modeled as a function of discharge, which can be estimated from water level and high-resolution elevation data. High-frequency in-situ measurements of lateral carbon fluxes at Mt. Eden Creek Marsh show net DIC export during the growing season, -208 g C-DIC m^-2. Preliminary model results show moderate agreement (R^2 = 0.45) between simulated lateral and observed lateral fluxes. These results show great potential for upscaling the model to the San Francisco Bay-Delta, enabling further insight into the climate mitigation potential of existing and proposed tidal wetlands in the region.

Keywords: Nature-based climate solutions, carbon sequestration, process-based modeling, lateral carbon flux, tidal wetlands, San Francisco Bay

Poster Topic: Data/Tools

Geomorphic River Reach Classification for Streams in the San Francisco Bay Area

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The nine-county San Francisco Bay Area, California, USA (hereafter referred to as the SF Bay Area) is characterized by densely urbanized centers, suburban developments, agricultural fields, and wildland areas. The region's stream network spans a continuum of channel conditions, ranging from wild and natural in the remote areas to completely engineered in the dense urban core. These variations result in distinct hydrogeomorphic processes and ecological functions at the reach scale. Stream reach classification helps describe and quantify the diversity of channel forms across a landscape, which guides restoration and conservation priorities. However, most existing stream classifications typically rely only on natural geomorphic attributes, with only a few dedicated to engineered (artificial) characteristics; none span both. As a result, there is a gap in classifying rivers in mixed-land-use watersheds influenced by both natural processes and human interventions. We here developed and implemented an integrated geomorphic classification framework that collects and analyzes field data spanning engineered and geomorphic stream attributes. From the surveyed data, we produced 59 variables from each of the 164 sites visited in the SF Bay Area. By using hierarchical cluster analysis on a subset of those variables, we identified 12 regional stream types, including six artificial and six natural types. We found that riverbank shape is the primary variable differentiating natural and artificial stream types. Natural stream types were mainly distinguished by degree of entrenchment, valley width, and sediment grain size. Artificial steam types were mostly separated by riverbank and bed composition, sediment grain size, and degree of entrenchment. Overall, the SF Bay Area stream classification produced by these efforts provides critical insights to understand and predict river behavior in urbanized and heavily managed regions, ultimately contributing to more effective river management and sustainable watershed planning.

Keywords: Geomorphic River Reach Classification, Aartifical and Natural Stream Types, Mixed-land-use Watersheds

Poster Topic: Data/Tools

The Bay Adapt Currents Dashboard: Metrics that Move with the Tides

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In 2021, The Bay Adapt Joint Platform, a consensus-based strategy to protect people and the natural and built environment from rising sea levels was published. Despite widespread buy-in throughout the region, there was no regionwide mechanism to track progress towards achieving the goals of the joint platform.
In April of 2025, the San Francisco Bay Conservation and Development Commission (BCDC) launched the Bay Adapt Currents, an interactive dashboard that tracks regional progress towards sea level rise adaptation. Based around the goals of the Joint Platform, the dashboard helps synthesize regionally available data to communicate progress to local officials, stakeholders, and the public.
This poster presentation would provide an overview of the 11 metrics in the Bay Adapt Currents Dashboard, highlighting the Sea Level Rise in General Plan metric. Data for this metric was collected by BCDC to assesses the extent to which local governments are incorporating sea level rise policies into their general plan. The Dashboard reveals that while nearly all Bay Area jurisdictions include sea level rise in some planning capacity, the extent of its inclusion varies greatly from jurisdiction to jurisdiction. By making adaptation progress visible and accessible, Bay Adapt Currents empowers users to better understand adaptation progress in the region. Tracking progress is essential for meeting our regional adaptation goals and ensuring that adaptation efforts are coordinated across jurisdictional boundaries. As the region continues to face accelerating climate threats, tools like Currents support more effective, equitable, and ecosystem-based decision-making — helping to advance estuary stewardship and shoreline resilience now and into the future.

Keywords: Interactive dashboard, general plans, sea level rise, public perception, funding, adaptation, media coverage, sediment

Poster Topic: Data/Tools

Ecological Restoration

Heron's Head Park Shoreline Resilience Project: Observations from Two Years of Post-Construction Monitoring

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The Heron's Head Park Shoreline Resilience Project, designed by Environmental Science Associates (ESA), and constructed by Dixon Marin in 2022 installed nature-based measures to reduce erosion rates and enhance shoreline habitats. Heron's Head Park is a 21-acre waterfront park in San Francisco, California managed by the Port of San Francisco. Built in the late 1990s on a former derelict marine terminal, the park is a valuable ecological and community asset, home to over 100 species of migratory and resident birds, rare and endangered plant and bird species, and enjoyed by thousands annually. The park's shoreline faces challenges due to subsidence and erosion driven by wind-waves and boat wakes. Portions of the park's shoreline have experienced more than 50 feet of erosion since 1999 (~2.5ft/year), resulting in loss of valuable tidal marsh and tidal pond habitats. The Project constructed a 1,600-foot long coarse gravel beach, nearshore oyster reefs, rocky headlands, wood habitat structures, and included ongoing native planting and invasive plant management.

This presentation will share observations and findings after two years of post-construction monitoring. ESA has developed comparisons of forecast versus actual rates of beach sediment migration, illustrating some of the strengths and limitations of existing beach sediment transport analysis methods, and demonstrating the benefits of combining aerial surveys with on-the ground observations and measurements. Biological monitoring demonstrates that the project is supporting key wildlife species, including providing valuable high-tide refuge areas for shorebirds and SERC has documented very high rates of oyster colonization on the reef elements. Finally, this presentation will highlight ongoing efforts by Literacy for Environmental Justice to manage invasive species and re-introduce the endangered California seablite (*sueada californica*).

Keywords: Living shorelines, nature-based solutions, gravel beaches, coastal restoration, green infrastructure, post-contruction monitoring

Poster Topic: Habitat Restoration

Nature-Based Shoreline Erosion Protection and Habitat Levee Reconstruction at the Sears Point Tidal Wetland Restoration Project

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The Sonoma Land Trust constructed the Sears Point Levee Adaptive Management Project (Project) in December 2021. This project is an adaptive management action of the Sears Point Tidal Marsh Restoration Project (constructed in 2015) in response to excessive wave erosion of the northern and western levees, associated impaired progress of the restoration project's ecological objectives, and potential risk to the northern tidal flood control levee integrity were erosion to continue. The 940-acre Restoration Project introduced tides to the subsided site and utilized natural sedimentation in this sediment-rich region of San Pablo Bay that over time would restore elevations suitable for emergent marsh establishment. Originally designed nature-based shoreline erosion protection elements that may have minimized or avoided the early levee erosion were not constructed. The adaptive management project along nearly two miles of levee aimed to function dynamically in concert with several natural processes to halt shoreline erosion, partially restore habitat levee slopes, set the shoreline back on course to establishing emergent tidal marsh and wetland-upland ecotone, and thereby re-establish the shoreline erosion protection functions. Placed dried bay mud (mud clasts) and coarse gravel were expected to move with the tides, forming a suite of marsh-beach-transition zone habitats and interacting with establishing native plant communities. Placed logs were expected to promote localized sediment deposition as well as reduce wave heights. Graded levee scarps were expected to resolve wave-reflected erosion and remain intact as ecotone levee slopes. Cordgrass plantings were expected to accelerate broad-scale colonization on the accreting mudflat at the levee slope toe. Brush fencing was expected to help shelter cordgrass plantings and provide extra wave attenuation along the highest energy shoreline reaches. Outcomes after three years have been exceptionally positive – extensive vegetation establishment, very minimal new shoreline erosion, and durable wetland and transition zone habitat development.

Keywords: nature-based strategies, coarse sediment, beach, living shoreline, habtiat levee

Poster Topic: Adaptation & Resilience

Natural Sedimentation: Sears Point Tidal Wetland Restoration

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Natural sedimentation to restore elevations of subsided diked Baylands is a common strategy. It is inherently effective where sediment supply is available, hydrologic connections facilitate sediment transport, and site configurations are amenable to deposition. Generally, natural sedimentation is far less costly than beneficial reuse or fill excavation as it involves far less earthwork. The downside to natural sedimentation is that it can take time – a mixture of baseline elevations, suspended sediment concentrations, and associated net accretion rates – and vegetation establishment often follows an "edge" or "bathtub ring" pattern that can start fairly rapidly in combination with interior isolated patches that can begin only after accretion has reached elevations and substrate conditions suitable for low-elevation plants. The 940-acre Sears Point Tidal Wetland Restoration Project is located on the northern shoreline of San Pablo Bay in an area with known high suspended sediment from the broad expanses of mudflat along with seasonal sediment loads from the Petaluma River and Delta outflow into San Pablo Bay. Starting elevations were roughly around MLLW. Large interior pilot channels were dug and soil reused for the setback habitat transition levee and about 500 small "marsh mounds" (crests at MHHW) were constructed throughout the site to diffract waves and be vegetation colonization nuclei. The levee was breached in two locations in October 2015, with a total cost of roughly $15 million. Accretion was rapid – within 5 years, 3 million cubic yards had deposited, raising elevations about 3 feet. Pending year-10 elevation data will quantify ongoing accretion. Vegetation colonization was hampered early by marsh mounds and habitat levee erosion, which were later remediated through adaptive management actions. Sears Point demonstrates natural accretion efficacy where ample sediment supply is available and the value of nature-based erosion protection elements, and it highlights the value of stewardship partnerships.

Keywords: Tidal marsh restoration, natural accretion, San Pablo Bay, habitat levee, marsh mounds

Poster Topic: Adaptation & Resilience

Hydrologic Improvements to a Centennial Tidal Marsh: The Sonoma Creek Marsh Enhancement Project

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The Sonoma Creek Marsh Enhancement Project, constructed in two phases between 2015 and 2020, was designed to improve tidal exchange and habitat function within a 300-acre tidal marsh at the mouth of Sonoma Creek within the San Pablo Bay National Wildlife Refuge (Refuge). Prior to project implementation, the marsh routinely impounded water for extended periods following spring tides and storm events in a large topographic basin in the marsh interior and between a series of relict levee alignments. Ponding led to high mosquito production rates and reduced vigor and cover of vegetation, which reduced habitat quality for several special status marsh-dependent wildlife species. The problems at this site are typical of "centennial" tidal marshes (formed over approximately the past 100 years on accumulated Sierra Nevada hydraulic mining sediments), which lack extensive tidal channel networks and habitat complexity characteristic of ancient San Francisco Estuary marshes. There is concern that centennial marshes may continue to degrade and revert to mudflat over time, a process that is likely to accelerate with sea level rise. The project, implemented by the Refuge in collaboration with Audubon California and the Marin-Sonoma Mosquito and Vector Control District, involved constructing a large channel through the central basin of the marsh, bisecting existing relict marsh channels and connected to Sonoma Creek. Excavation spoils were used to create structural habitat elements, including marsh mounds, high marsh "lifts", and a habitat ecotone ramp along the adjacent upland levee. Within three years following phase 1 construction, the site experienced a reduction in mosquito production, revegetation of nearly 100% of the central basin "dead zone", and an increase in wildlife use. This presentation will provide an update on project site conditions in 2024, nine years post-construction, and discuss lessons-learned and implications for other proposed centennial marsh restoration projects in San Pablo Bay.

Keywords: tidal marsh restoration, North Bay, resilience, horizontal levees

Poster Topic: Habitat Restoration

The Role of Mitigation Banks in San Francisco Bay Estuary Recovery

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Tidal marsh habitat has declined by approximately 75% in the San Francisco Bay (Bay) in the last 200 years, from over 200,000 acres to 51,300 acres today (San Francisco Estuary Blueprint, 2022). Tidal marsh acreage in the Bay needs to double to meet the 100,000-acre goal laid out in the 1999 Baylands Ecosystem Habitat Goals Report (updated in 2015). To achieve this goal, it is essential to both protect existing tidal marsh habitat and restore previously modified wetlands to a state of high ecological function. Mitigation and conservation banks (Banks) are an important and effective tool in restoring wetland habitat in the San Francisco Bay. By providing financial incentives to private landowners, the establishment of Banks conserves properties that may otherwise not be in the conservation space. Additionally, Banks are subject to long-term monitoring and must meet agency-specified performance standards. These requirements, in addition to placing a conservation easement in-perpetuity on the property, support a long-term restoration vision.

Halo Ranch Mitigation Bank is an approximately 122-acre property located in the upper San Pablo Bay that will provide high-quality habitat and numerous benefits to the overall goals of San Francisco Bay tidal marsh restoration. Halo Ranch is adjacent to the Petaluma Marsh Wildlife Area, the largest contiguous stretch of tidal marsh habitat in the San Pablo Bay. Halo Ranch was historically part of this remnant tidal marsh habitat until it was modified for railroad access and agricultural use in the 19th century. Restoration of this property using the vehicle of mitigation banking provides a unique opportunity to restore over 100 acres of high-quality tidal marsh and other wetland habitat. Halo Ranch Mitigation Bank supports the Estuary Blueprint by directly improving estuarine habitats with a project designed to withstand the effects of climate change that will be protected in perpetuity.

Keywords: habitat restoration, mitigation, mitigation banks, tidal wetlands, private land

Poster Topic: Habitat Restoration

Tracking Lateral Carbon Fluxes Across Salinity and Land-Use Gradients to Inform Estuarine Restoration and Resilience

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Tracking Lateral Carbon Fluxes Across Salinity and Land-Use Gradients to Inform Estuarine Restoration and Resilience
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Abstract
Problem statement:
Tidal wetlands are key drivers of estuarine health, supporting biodiversity, water quality, and carbon cycling. However, the lateral export of carbon, specifically dissolved inorganic carbon (DIC), dissolved organic carbon (DOC), and particulate organic carbon (POC), remains an understudied component of estuarine function, particularly with salinity gradients and land-use. These fluxes directly influence food web productivity, acid-buffering capacity, and sediment dynamics, yet few data exist to guide restoration planning or resource management. A lack of data on how these factors interact limits the effectiveness of wetland restoration and land-use management strategies.
Approach/Method:
This project investigates lateral carbon fluxes in the San Francisco–San Joaquin Delta across three wetland sites representing a range of salinity and land-use histories: Eden Landing (saline, restored salt pond), Rush Ranch (brackish, reference site), and Dutch Slough (freshwater, restored agricultural land). We combine high-frequency in-situ measurements, discrete water sampling, and atmospheric flux monitoring to quantify seasonal and event-driven patterns of carbon transport.
Preliminary findings indicate that land use has a significant impact on estuarine carbon dynamics. Current and historical urban and agricultural land-use influence hydrology, nutrient inputs, and salinity. These influences shift microbial processes, such as sulfate reduction and methanogenesis. These shifts alter the quantity and quality of carbon exported, with implications for fisheries, acidification buffering, and habitat function.
Conclusion:
By integrating biogeochemical data with predictive and process-based modeling, this study provides new tools for evaluating restoration outcomes, improving wetland design, and supporting co-management strategies that advance both ecological resilience and community priorities. Deliverables include open-access datasets, policy briefs, and engagement with resource managers and underserved communities to ensure that results are translated into actionable guidance for estuarine sustainability.

Keywords: Lateral, Carbon, Flux, Wetlands, Resilience, Dissolved, Particulate, Restoration, Modeling, Land-use

Poster Topic: Food Webs

Fish in the Estuary

Dispatch from the Bay's Fish Passage Renaissance: Reconnecting Wildcat Creek

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As momentum builds for fish passage restoration across California, urban creeks like Wildcat Creek present both a challenge and an opportunity. The Wildcat Creek Fish Passage and Community Engagement Project, located in North Richmond, tackles a critical migration barrier in a concrete-lined flood control channel, while also addressing sediment management, public access, and community use. The project replaces a clogged, outdated fish ladder with a roughened ramp and step-pool system designed to meet current criteria from CDFW and NMFS for Central California Coast steelhead. It also reconfigures a downstream sediment basin to maintain conveyance while supporting a stable low-flow channel and preserving riparian habitat. Upstream channel modifications and debris deflection features help reduce maintenance needs and improve hydraulic performance.

Planning and design have centered on multi-benefit goals. The project balances fish passage with flood infrastructure requirements, buried utilities, and tight construction windows. Through interagency collaboration and early coordination with regulatory partners, the team developed a buildable, ecologically meaningful design in a highly constrained setting.

Community engagement is a central focus. Located next to a school in a historically underserved neighborhood, the project includes a mini-park, interpretive signage, and a creek overlook to create meaningful public access and environmental education opportunities. Engagement efforts have emphasized local input and partnerships to support long-term stewardship.

This poster will share the design approach, permitting strategy, and community integration efforts that have defined the planning process. As construction approaches, the Wildcat Creek project offers a model for how the Bay Area's fish passage renaissance can include its urban streams and the people who live alongside them.

Keywords: steelhead, fish, wildcat, creek, restoration, habitat, richmond, salmon, adpatation, passage

Poster Topic: Species and Communities - Fish

Assessing the Life History of Central Valley Steelhead Using Otoliths

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The California Central Valley Steelhead (CVS) is a distinct population of anadromous Rainbow Trout (Oncorhynchus mykiss) that is listed as 'threatened' under the Endangered Species Act. Critical information gaps regarding our knowledge of Steelhead demographics and life histories in the Sacramento and San Joaquin River watersheds hinder their effective management and conservation. Here we report on the preliminary results of an ongoing collaboration between the Otolith Geochemistry & Fish Ecology Laboratory at UC Davis, the Norwegian Institute for Nature Research, the US Bureau of Reclamation, and the CA Dept. of Fish and Wildlife. In this project we are utilizing increment and geochemical analyses of archived otoliths (ear stones) from 700 CVS to reconstruct the age structure, growth, and migratory life history of Steelhead from the Sacramento, Feather, American, Tuolumne, Merced, and Stanislaus Rivers. These data will allow us to explore the region-wide variation in the life history of CVS. Our initial findings highlight the value of otoliths in providing age, growth, and migratory information for CVS life history analysis. Annual age of adult CVS was reconstructed using opaque and translucent banding patterns. Daily growth rate of the juvenile part of the otolith was reconstructed from daily increment widths. Life history patterns such as natal origin, migratory phenotype, and maternal phenotype are reconstructed using Strontium isotopes (87Sr/86Sr).

Keywords: steelhead, rainbow trout, otolith, geochemistry, strontium isotopes, life history

Poster Topic: Species and Communities - Fish

Assessing Longfin Smelt Age, Maturation, Fecundity and Life History within the San Francisco Estuary

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The genetically distinct Longfin Smelt (*Spirinchus thaleichthys*) population in the San Francisco Estuary (SFE) has undergone marked declines in recent decades, elevating concerns about its risk of local extinction. Effective conservation strategies for this imperiled population require robust population models informed by accurate estimates of life history parameters such as age-at-maturity, size-at-maturity, and size-specific fecundity. To fill this knowledge gap, our lab analyzed archived individuals collected from across the estuary over the past two decades. We developed non-destructive, image-based methods for evaluating gonad maturation and estimating total batch fecundity and applied these methods to assess ontogenetic, temporal, and spatial patterns in reproductive traits. Our findings reveal a female-skewed sex ratio (3:1), with a Gonadosomatic Index (GSI) increasing sharply in fish exceeding 65 mm fork length (FL), and up to 33% of total body mass comprised of gonads. Females with maturing or spawn-ready ovaries were 70–128 mm FL and contained 300–18,000 oocytes, with an average of 95 mm FL and ~5000 oocytes. LFS oocytes generally exhibited synchronous development, but the presence of ovaries with atrophied and developing oocytes provides evidence of multiple spawning events either within a given season or across multiple seasons in some individuals. Concurrently, we have reconstructed age and growth histories from otoliths using seasonally produced transparent and opaque bands (“annuli”), image analysis, and strontium isotope geochemistry (MC-LA-ICP-MS). To date, age and growth data from ~900 archived specimens have been generated, indicating individuals reaching 3 years of age are born in medium to high salinities . Integration of reproductive and otolith-derived data will enable the estimation of size- and age-at-maturity, contributing essential life history parameters for population models. Collectively, this research enhances our understanding of the life cycle dynamics of Longfin Smelt and informs conservation strategies aimed at reversing population decline in the SFE.

Keywords: Longfin Smelt, Otoliths, Fecundity, San Francisco Estuary, Geochemistry, Eggs, Life History, Aging, Annuli

Poster Topic: Species and Communities - Sensitive Species (including listed species)

A multi-gear approach to evaluate impacts of the San Francisco Bay Living Shorelines Project on fish community abundance and diversity

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Restoration efforts are important to maintain, improve, and bolster estuary habitats and species they support in the face of climate change and anthropogenic impacts. To reach these goals, it is necessary to evaluate impacts of these restoration efforts on native species. Often, singular methods cannot comprehensively assess fish communities in such dynamic ecosystems. The San Francisco Bay Living Shorelines Project at Giant Marsh was a large-scale restoration effort to provide forage and habitat resources for native species. The project, completed in 2019, consists of 368 acres of existing tidal marsh, oyster reefs, mudflats, and eelgrass beds located within the Point Pinole Regional Shoreline in Richmond, California. Post-project monitoring in July 2022 utilized environmental DNA (eDNA), an ARIS sonar camera, and two physical sampling gears (seine and hoop nets) to compare fish assemblages, relative abundance, and habitat use of fishes among two unrestored control sites (unvegetated mudflats; natural eelgrass beds) and two restored treatment sites (eelgrass beds; restored oyster reefs). We observed 19 fish species, with 63% only detected by a single sampling gear, suggesting mixed-gear approaches may provide more complete assessments of fish communities. The sonar camera detected more fish and larger fish (>1m in length) compared to traditional sampling gear, although sonar cameras do not usually allow for species identification. eDNA samples detected six species not captured in seine or hoop nets, suggesting that eDNA is useful to detect species that evade traditional sampling methods. Species composition, size composition, and relative abundance were generally similar across restored and unrestored sites, likely due to the relatively short time since project completion and because fish assemblages readily mix in the dynamic, open intertidal zone. These data show the importance of a multi-method approach to understand impacts of estuary habitat improvement efforts on native species assemblages, a key component of estuary stewardship.

Keywords: fish populations, monitoring, fisheries, fish community

Poster Topic: Species and Communities - Fish

Advancing Scientific Understanding and Management of the Delta Through a Food Web Perspective

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The Delta is a complex ecosystem characterized by multiple food webs dynamics. The ability to predict the impact of habitat restoration, fishery management actions, changes in environmental drivers on ecological carrying capacity and productivity, as well as the bioaccumulation of contaminants on species and the ecosystem, requires an understanding of food web processes. The Delta Independent Science Board, which is legislatively mandated to provide scientific oversight of adaptive management, has finished conducting a review of the current and emerging science related to food webs, with emphasis on upper trophic food webs. This poster will provide an overview of findings and recommendations from the review. The goal of the review is to provide relevant information to help organizations, including State and federal agencies, assess how to better incorporate and advance food web knowledge in managing the Delta's ecosystems and to identify what tools are available or should be developed. This review is based on an analysis of published literature, public comments, community engagement through a series of conference calls, and a focused two-day workshop. A key finding is that an improved mechanistic understanding of food webs is essential to predict the impacts of biophysical drivers and management actions on individual fish species and ecosystem-level processes. Collaboration among agencies, academia, Indigenous Tribes, and the public, along with adaptive management, will be needed to make implementation of the recommendations efficient and effective. The benefits will be improved capacity to forecast effects on fish and other aquatic organisms due to management actions and their interactions with an ever-changing climate and ecosystem.

Keywords: food webs, Delta, Delta Independent Science Board

Poster Topic: Food Webs

Impacts of the 2022 Harmful Algal Bloom on Green and White Sturgeon in the San Francisco Estuary

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In summer 2022, a harmful algal bloom (HAB) caused by *Heterosigma akashiwo* triggered one of the most extensive fish mass mortality events (MMEs) ever recorded in the San Francisco Estuary (SFE). The bloom rapidly expanded across over 4,500 km² of estuarine habitat, causing widespread fish die-offs, particularly impacting sturgeon. Nearly 700 sturgeon carcasses were documented, including both Green Sturgeon (*Acipenser medirostris*), a federally threatened species, and White Sturgeon (*Acipenser transmontanus*), which is currently under consideration for endangered species protection. Sturgeon are long-lived, late-maturing species with diverse migratory behaviors and life histories adapted to California's highly variable aquatic environments. The 2022 event raised urgent concerns about long-term population viability and potential habitat-specific vulnerabilities. While hypoxia played a role during later bloom stages, most sturgeon deaths occurred before oxygen levels dropped, suggesting toxins and reactive oxygen species produced by *H. akashiwo* were the primary cause of mortality. To better understand the impacts of this event, we integrated community science reports, scientific surveys, and geochemical analyses of sturgeon pectoral fin rays to reconstruct age, residence and migration histories. By comparing individuals collected before, during and after the bloom, we aim to identify specific migratory phenotypes or life history traits that may have increased vulnerability to HAB conditions. This research highlights the need for real-time monitoring of HABs and fish kills, targeted conservation actions for vulnerable life stages, and improved understanding of how environmental stressors intersect with species behavior. Findings will inform estuary stewardship by supporting adaptive management of sturgeon populations and guiding restoration, flow, and water quality decisions to promote resilience in the face of climate change and increasing HAB frequency.

Keywords: Harmful Algal Bloom, Sturgeon Mortality, White Sturgeon, Green Sturgeon, Mass Mortality Event, Fin Ray Geochemistry, Heterosigma Akashiwo

Poster Topic: Species and Communities - Sensitive Species (including listed species)

Elasmobranchs in Lower South SF Bay (LSB)

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Leopard Sharks and Bat Rays are among the most charismatic fishes in the San Francisco Estuary. Adult females migrate into warm Bay waters to give live birth to litters of pups in summer. Guitarfish follow the same pattern. Warm water temperature and low and variable salinity in Lower South San Francisco Bay create a refuge for young sharks and rays from larger predators that inhabit deeper cooler ocean waters.

We tracked these three species via monthly otter trawl surveys in Lower South San Francisco Bay. Results show a significant increase in Bat Rays from 2014 through 2024. Trawl catches of Leopard Sharks and Shovelnose Guitarfish are still too variable to reach firm conclusions. Leopard Shark totals peaked in 2022 and then declined thereafter. Guitarfish were absent until 2019, and their numbers also peaked in 2022. Winter precipitation and the subsequent impact on ambient salinity is a major factor: pregnant females are discouraged when warm-season salinity decreases too low for too long.

These top-of-the-food-web foragers can serve as sentinels of overall health of the estuarine system in addition to the ecological services they provide by controlling populations of mollusks and other benthic creatures.

Keywords: Elasmobranch, Bat Ray, Leopard Shark, Guitarfish, South San Francisco Bay, OGFL, Salt Pond Restoration, salinity

Poster Topic: Habitat Restoration

Flatfishes in Lower South SF Bay (LSB)

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Flatfishes are important recreational and commercial game fishes. Lower South San Francisco Bay is a reliable nursery to at least three species: California Halibut (Paralichthys californicus), English Sole (Parophrys vetulus), and Starry Flounder (Platichthys stellatus).

Through monthly otter trawl surveys, we monitored these three species over a ten(+) year period. Results showed that the global El Nino Southern Oscillation (ENSO) cycle influenced at least two species. California Halibut populations surged in LSB during, or shortly after, El Nino years. English Sole numbers in LSB increased during La Ninas. This is consistent with published literature. Starry Flounder catches varied widely between 2012 and 2024. Unlike Halibut and Sole, Starry Flounders in LSB are not strongly influenced by global Sea Surface Temperatures as measured in the tropical Pacific Ocean. Local environmental factors must exert a stronger influence on Starry Flounder recruitment.

These three species of flatfishes are products of very different regions in the San Francisco Estuary: English Sole hatch in coastal waters and migrate into the Bay while still very young, California Halibut hatch and recruit in the Bay, Starry Flounder generally spawn at the mouths of creeks. Conceptually, the three species diagnose the widest possible range of estuarine habitats from creeks to the ocean. In practice, twelve+ years of monitoring confirmed an ENSO influence and possible clues regarding the creek-estuarine connection. These findings suggest that abundances of flatfishes in LSB alone give insight into global climate change.

Keywords: Flatfishes, California Halibut, Starry Flounder, English Sole, Paralichthys californicus, Parophrys vetulus, Platichthys stellatus, Salt Pond Restoration, Climate Change, El Nino Southern Oscillation

Poster Topic: Habitat Restoration

Gobiids in Lower South SF Bay (LSB)

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Collectively, gobiids perform essential ecosystem services as benthic invertebrate predators and as prey for larger fishes. There at least eight species of gobies, four native and four non-native, that inhabit Lower South San Francisco Bay (LSB). These small bottom-dwellers are well-known for exhibiting high-site fidelity (e.g. they tend to live out their lives in or near one location). For that reason, their presence and relative abundance can provide clues regarding bottom conditions and food availability.

Monthly otter trawl surveys from 2012 through 2024 revealed a surprising twist. A new non-native goby, the Shimofuri (Tridentiger bifasiatus) from Asia, appeared to arrive in LSB in, or just before, 2012. Over the monitoring period, yearly Shimofuri numbers increased from just a few to the thousands by 2021, even briefly surpassing the numbers of Yellowfin Gobies (Acanthogobius flavimanus) that had been the dominant goby since at least the 1970s. Limited comparable data from the mid-1980s indicate that the native “Bay Goby” (Lepidogobius lepidus) was still commonly seen at that time. Bay Gobies have been rare since 2012. It is thought that arrival of non-native Shimofuris and Shokihazes specifically impacted Bay Gobies through competition but left native Arrow and Cheekspot gobies unaffected.

Seasonal timing of spawning and recruitment amongst the local goby species heavily influences intra-gobiid competition in addition to food availability for larger predatory fishes. Monthly fish surveys by otter trawl have proven effective for tracking gobiid population trends and changes over time.

Keywords: Gobiids, Shimofuri Goby, Shokihaze Goby, Bay Goby, Yellowfin Goby, Tridentiger bifasiatus, Lepidogobius lepidus, Acanthogobius flavimanus, Salt Pond Restoration, OGFL

Poster Topic: Habitat Restoration

Clupeiforms in Lower South San Francisco Bay.

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The Clupeiform order of fishes includes many ecologically important pelagic species. Lower South San Francisco Bay (LSB) regularly hosts at least four members of this order: Northern Anchovies (Engraulis mordax nanus), Pacific Herring (Clupea pallasii), American Shad (Alosa sapidissima), and Threadfin Shad (Dorosoma petenense). The four species serve as significant forage for estuarine birds, mammals, and larger fishes.

Anchovies migrate into LSB to spawn during the warm months. Herring perform an analogous spawning run around December through February. Shad also migrate into LSB in winter, however, Shad spawning has not been observed in LSB to date. The presence and spawning success of these four species have enormous impacts on both LSB and the greater San Francisco Estuary.

Monthly otter trawling surveys performed at 20 stations in LSB since 2012 have detected regular and reliable spawning amongst the Anchovies. The Herring spawn in LSB has been intermittent. Both species appear to be heavily dependent on restored Salt Ponds for spawning and recruitment habitat.
These findings highlight the value of marsh restoration and a major benefit gained from the South Bay Salt Pond Restoration Project in particular.

Keywords: Clupeiforms, Northern Anchovy, Pacific Herring, American Shad, Threadfin Shad, Clupea Pallasii, Engraulis mordax nanus, Lower South San Francisco Bay, Salt Pond Restoration, OGFL

Poster Topic: Habitat Restoration

Longfin Smelt across the San Francisco Estuary

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Longfin Smelt (*Spirinchus thaleichthys*) is an endangered migratory fish that's native to the San Francisco Estuary. Once abundant, their numbers have declined due to habitat loss, reduced freshwater flow, and environmental change. Recent surveys have highlighted that all life stages utilize brackish wetland habitats across the Estuary during fall-winter months. Thus, restoration of tidal wetlands and managed ponds may offer new habitat, but additional studies are needed. Here we summarize recent observations of Longfin Smelt in shallow wetlands across the lower Estuary, with implications for future monitoring, restoration, and research.

Keywords: Longfin Smelt, *Spirinchus*, surveys, wetlands, marsh, restoration

Topic: species and communities - fish

Monitoring Aquatic Species Responses to Tidal Wetland Restoration in the San Francisco Estuary

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Tidal wetlands are among the most productive aquatic habitats, yet they have undergone extensive global degradation, impairing ecosystem functions and reducing native species viability. In the San Francisco Estuary (SFE), over 90% of historic wetland habitats have been lost, contributing to widespread declines in native aquatic species and prompting large-scale tidal wetland restoration efforts. To evaluate ecological responses to restoration, UC Davis has conducted fish, macroinvertebrate, and water quality monitoring in Suisun Marsh since 1980 and in the Alviso Marsh complex of Lower South San Francisco Bay since 2010, supporting adaptive management under the South Bay Salt Pond Restoration Project. In April 2025, we expanded monitoring to include additional restoring wetlands in Napa-Sonoma, Petaluma, West San Pablo Bay, Wildcat Creek, Eden Landing, and Bair Island as part of the Wetland Regional Monitoring Program (WRMP). Here, we used multivariate analyses to examine spatial and temporal patterns in fish and invertebrate assemblages, their relationship to water quality gradients, and their response to wetland restoration. We found that assemblages in restored and adjacent wetland habitats are spatially and temporally dynamic and shaped by both local and regional environmental conditions. While native species persist in many areas, non-native taxa increasingly dominate. These findings underscore the value of long-term, regionally distributed wetland monitoring to detect ecological change and guide adaptive management. By linking community composition to restoration efforts, this work directly supports estuarine stewardship by helping managers evaluate restoration outcomes, refine performance metrics, and promote resilient, sustainable wetland ecosystems amid accelerating climate and land-use change.

Keywords: Tidal Wetlands, San Francisco Estuary, Restoration, Fish, Invertebrates, Water Quality, Monitoring

Poster Topic: Habitat Restoration

Science Communication

Delta Science Tracker: Advancing collaboration and transparency for One Delta, One Science

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The Sacramento–San Joaquin Delta is home to a broad range of scientific and management efforts led by government agencies, academic institutions, non-governmental organizations, and private research groups. To support transparency, accountability, and opportunities for collaboration concerning these efforts, the Delta Science Program created the Delta Science Tracker as a publicly accessible, web-based platform that organizes and shares information on Delta-focused research and monitoring projects. Designed to support the vision of "One Delta, One Science," the Tracker enables those interested in the Delta to easily find activities, discover new connections, and communicate outcomes. The *Delta Science Tracker* acts as a catalyst for collaboration, connecting scientists, managers, and decision-makers across disciplines and regions. Early use of the Delta Science Tracker has revealed gaps and synergies in research, helped funders and managers summarize investments toward Science Action Agenda priorities, and promoted communication among different partners. By fostering transparency and coordination, the Tracker enhances our capacity to support resilient decision-making and effective stewardship of the Delta and San Francisco Estuary.

Keywords: Delta, science, research, tool, communication

Poster Topic: Science Communications

Delta Plan Success Metrics Inform Management Priorities

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The Sacramento-San Joaquin Delta (Delta) is a distinct region of the San Francisco Estuary. The Delta is an important biodiversity hotspot, a critical hub for California water supply, and a place of unique historical, cultural, and agricultural significance. Recently, the Delta became California's first National Heritage Area, a designation for distinctive places that tell a nationally important story about the country and its experience. Considering these diverse and competing demands, understanding how successful we are in managing Delta's complex ecosystem remains challenging. The Delta Stewardship Council (Council), in coordination with others, developed a long-term and science-based management plan for a sustainable Delta, setting measurable targets to track progress toward reliable water supply, healthy ecosystem, and preserving the Delta unique character. In using these performance measures, the Council has undertaken an innovative effort that is essential to success in managing the Delta ecosystem while also supporting government accountability and transparency. A review of the Delta Plan completed in 2024 used 'report cards' to rate ten-year progress toward the established performance measure objectives. Like an academic report card, these at-glance infographics offer a big-picture view of what is happening in the Delta. The 2024 Review also identifies ways to improve performance metrics to support adaptive management, expand our collective understanding of progress toward the coequal goals, inform complementary efforts in policy and management arenas, and deliver an impetus for greater involvement and ownership of performance assessment and reporting, across agencies and interests. As they say, 'the proof of the pudding is eating it', by using the Delta Plan report cards and Council's performance measure dashboard we have taken the first few bites.

Keywords: Delta, ecosystem, water supply, management, performance measures, indicator, success, adaptive management

Poster Topic: Watershed Management

“Science is Life” = What 10 Experts Say about the Estuary and Bay–Delta and How it Sustains Life in California

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“Science is Life” = What 10 Experts Say about the Estuary and Bay–Delta and How it Sustains Life in California

California’s San Francisco Estuary and Sacramento-San Joaquin Bay-Delta system is a vital ecological hub that supports biodiversity, water supply, agriculture, and diverse knowledge systems. This poster synthesizes insights from ten leading experts in hydrology, ecology, climate science, environmental policy, and Indigenous knowledge to highlight how this interconnected system sustains life in California. Key themes include:

1. Living Resources – The Delta’s wetlands and waterways provide critical habitat for endangered species like Delta smelt and salmon, maintaining food web stability are in over-extraction, pollution, and invasive species threaten ecosystem health, requiring science-based management.

2. Water Supply and Agriculture – Experts emphasize the Delta’s role in supplying freshwater to millions of residents and irrigating Central Valley farms, underpinning California’s economy, its benefits and economic costs,

3. Climate Resilience – Scientists discuss how restored estuaries mitigate floods, sequester carbon, and buffer against sea-level rise and extreme weather events.

4. Traditional Ecological Knowledge (TEK) – Researchers highlight the contributions of Indigenous science and stewardship, preserving centuries of sustainable water and land management practices, which offer solutions for modern conservation and restoration efforts carried by predominant science.

5. Policy and Restoration – Experts advocate for sustainable water-supply improvement actions, habitat restoration, and adaptive governance to balance human and ecological needs.

Collectively, these perspectives underscore that the Estuary and Bay-Delta are not just an ecosystem but a life-support system of living resources. Protecting it demands interdisciplinary collaboration, innovative science, and the integration of Traditional knowledge and predominant science. This poster illustrates why science-driven stewardship—informed by both modern and Traditional knowledge—is essential to securing California’s future in the face of climate change and growing demands.

Keywords: expert interviews, knowledge paradigms, resilience, policy, water supply, climate change, ecocultural restoration, sustainability, informed ecological management, scholarly communication

Poster Topic: Science Communications

Sediment

Watershed sediment supply into the future: a case study for the Petaluma River

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Evaluating future streamflow and sediment loading in river systems is necessary for developing management approaches that support ecosystem resilience. In this study of the Petaluma River watershed in the San Francisco Bay region, we quantified the average annual sediment supply in a detailed, field-based sediment source assessment and used a hydrological model to estimate possible changes in streamflow and sediment loading based on future projections of different precipitation patterns.

Over the past several decades, the Petaluma River watershed's average annual sediment supply is estimated to be approximately 59,000 t/yr, equivalent to an average annual sediment yield of approximately 185 t/km2/yr. Of this, sediment sources were quantified from four categories: 1) channel erosion (71%), 2) soil creep and sheetwash (8%), 3) landslides (15%), and 4) road-related erosion (6%). Total yield and individual contributions from different sources are similar to estimates for other watersheds in the region.

For different future precipitation regimes, we found that streamflow and sediment loading is projected to change dramatically in some areas of the watershed for certain models. Changes in average daily streamflow ranged from -20% to +20% of current values by mid-century and -12% to +60% by end-of-century. Changes in average annual sediment load ranged from -45% to +125% of current values by mid-century, and -18% to more than +250% by end-of-century. This work suggests that the contemporary sediment loading from the Petaluma River watershed is typical of systems in the area, but that greater extremes under future conditions should be expected. These findings point to the importance of management and restoration actions that build ecosystem resilience and buffer against high-intensity storms in adaptable ways.

Keywords: sediment, future, field work, petaluma, bay area, precipitation

Poster Topic: Sediment

Monitoring Suspended Sediment Flux from Fluvial and Estuarine Sources in Tidal Slough Habitats of South San Francisco Bay

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Consistent with the South Bay Salt Pond Restoration Project goals of tidal habitat wetland restoration, enhanced public access, and flood management, the Calabazas and San Tomas Creek Marsh Connection Project was awarded grant funding from the San Francisco Bay Restoration Authority, California Dept. of Fish and Wildlife and USEPA to re-establish fluvial and tidal connections between riverine, creek, and estuarine habitats of southern San Francisco Bay, benefiting sediment transport, capture, and tidal marsh re-establishment.

As part of Project planning, Valley Water undertook, sediment flux monitoring in Alviso and Guadalupe Sloughs during 2023 and 2024 to provide validation data for hydrodynamic modelling and a baseline for post-project comparisons of sediment transport and long-term sediment deposition. Continuous acoustic doppler profiling and turbidity monitoring coupled with depth-integrated suspended sediment sampling in tidal slough habitats provides estimates of bayward and landward sediment fluxes on tidal and seasonal scales. To estimate sediment flux from the continuous data, periodic boat-mounted ADCP discharge measurements and depth-integrated SSC samples were collected concurrently with the continuous data to develop site-specific equations for cross sectional area, mean velocity, and average SSC. Previous sediment flux estimates were conducted in Alviso Slough during 2012-2014 (Shellenbarger et al 2015) and were compared to results from this study. Initial findings from this study support previous findings of tidal asymmetry characterized by flood-dominant sediment flux that may be available for sedimentation in adjacent marshes and ponds. Baseline results are considered in light of previous studies and modeling of Project restoration alternatives that show rapid sediment accumulation following re-establishment of former salt ponds with tidal habitats of South San Francisco Bay.

Keywords: ADCP, Calabazas, Flux, Methods, Pond, Restoration, SBSPRP, Sediment, Tide, Tidal, Turbidity

Poster Topic: Sediment

Bay Sands: Sources, Transport, and Supply - What We've Learned

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The Bay has two primary sediment types, sand and mud. Because of work around wetland restoration and navigation dredging, we know a fair amount about mud, but sand, not so much. Sand mining in the Bay has been occurring for many decades with little understanding of how much sand there is, where it comes from, where it's going, and the impacts the mining has on the sediment system. Over the past several years, BCDC and the Coastal Conservancy have initiated and supported scientific investigations into the sandy deep water shoals of the Bay. Research teams, including SFEI, Deltares, Anchor QEA, US Geological Survey, and the University of Texas at Austin have conducted multiple studies to unlock the mysteries of sand in the Bay and it's connection to the Delta and the Pacific Coast. An Independent Science Panel of experts has written a findings report synthesizing the information in the research. This poster will summarize and share those findings with the audience.

Keywords: Sediment, sand, habitat, transport, bathymetry, provenance, modeling

Poster Topic: Sediment

Species and Communities

Analyzing Ballast Water Treatments, Invasive Species, and Pathogens, and A Decade-Long Analysis on the San Francisco and Baltimore Ports

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Installation of advanced technologies to treat ballast water on ships is necessary to meet current ballast water management standards and reduce the secondary spread of invasive species during intracoastal voyages. This research includes a literature review on non-native aquatic species, particularly diapausing eggs, and available treatment methods for installation. A comparative analysis from 2014 - 2024 on bulker, tanker, and container vessels arriving coastwise to the ports of San Francisco and Baltimore was performed to evaluate treatment installation trends, traffic patterns, and the effectiveness of treatment(s) on targeting diapausing eggs. Use of ultraviolet (UV) radiation combined with filtration has increased across the decade for both ports. However, this combination is less effective against diapausing eggs. The San Francisco port experiences high vessel traffic within California, while Baltimore sees variable traffic across Canada, New Jersey, and New York. Macro-level invasive organisms like the European Green Crab (Carcinus maenas) pose significant economic, environmental, and ecological damage, while microorganisms like Cholera (Vibrio cholerae) risk contaminating the water supply through ballast discharge. Treatment methods fall into five categories: mid-ocean exchange, mechanical, physical, chemical, and a combination of treatments. Based on analysis results, this research recommends expanding East Coast research on secondary spread via intracoastal traffic by applying West Coast frameworks by using publicly accessible data, such as the NBIC, to conduct risk assessments. Additional field research on diapausing eggs is needed, using Artemia (brine shrimp) as a model organism. Given the current understanding, filters are recommended as a primary treatment against diapausing eggs.

Keywords: Ballast water, secondary spread, intracoastal spread, invasive species, pathogens, ballast water treatments, estuary.

Poster Topic: Invasive Species

Bird Nests as Botanical Time Capsules

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Museum nest specimens are botanical time capsules containing invaluable historical information about the plants from a specific place and time when they were built. Plants identified from historical nests can unlock new information about the ecology of extinct habitats. For example, surrounding the San Francisco Bay estuary were transitional habitats - the ecological gradient between the tidal marsh and the upland. Transitional habitats were lost during the 1900's due to human-caused land use changes, and consequently, very little is known about this former native plant community. In attempts to improve our understanding of this endangered habitat and inform restoration efforts, we sampled ~100 year old song sparrow and savannah sparrow nests collected along the margins of the San Francisco Bay estuary from natural history collections across the country. Although most plant materials in the 20 nests we studied were visually unidentifiable, we were able to successfully extract DNA, perform PCR and conducted next-generation DNA sequence analysis on over 200 total nest samples. From this, we have confirmed the identity of some previous plant species from the transitional habitat and added several new residents to this list. We also had several unexpected insights into the history of the San Francisco Bay estuary from our results. From these investigations, it is clear that historical nest materials can be used to reconstruct lost habitats thereby contributing essential historical information to help guide ongoing restoration efforts.

Keywords: transitional habitat, bird nest, plant restoration, DNA sequence comparisons, DNA barcoding, ancient DNA, museum collections

Poster Topic: Habitat Restoration

"Corm Condos": Nesting on the Bay Bridge is an urban estuary success story

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The largest colony of Double-crested Cormorants (*Nannopterum auritum*) in San Francisco Bay estuary resides on the eastern span of the San Francisco-Oakland Bay Bridge. This seabird adopted the steel girders and I-beams under the roadway as nesting habitat around 1984, reaching a peak nest count of 814 nests in 2007. The colony declined as the demolition of the earthquake-damaged east span was replaced with the the seismically upgraded bridge. Cormorants continued to nest on the old structure as long as they could, ignoring specially designed set of platforms (also known as "corm condos"), 7200 square feet of stainless steel shelving attached to the interior sides of the bridge. The cormorants even eschewed the social attraction devices (i.e., cormorant decoys, wreathes to look like nests, mirrors, sound system broadcasting cormorants calls). Finally, in 2017, seven years after the platform placement, and after the last vestiges of the old bridge was gone, cormorants colonized the "condos", and over 300 nests were counted in this inaugural year. Since then, the colony has continued to grow, and in 2025, 773 nests were counted, almost reaching peak numbers from nearly two decades earlier. Since the 'corm condo' square footage was based on the peak of 800 nests, this colony may not have much more room to grow, yet we celebrate the resilience of this species that is able to utilize urban structures and thrive in an ever-changing estuary.

Keywords: cormorant, seabird, bridge, nesting, urban

Poster Topic: Adaptation & Resilience

Rapid recolonization by California black rails of restored tidal wetlands in Suisun Bay

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The Contra Costa County Water Conservation and Flood Control District constructed the Lower Walnut Creek Restoration Project to restore and enhance coastal wetlands and adjacent habitats at the mouth of Walnut Creek, providing flood protection while also improving habitat quality, diversity, and connectivity along the creek channel. The project is located along the southern shoreline of Suisun Bay, east of Martinez, Contra Costa County, California. Restoration has been accomplished by breaching and lowering levees, berms, and supratidal elevation lands to reintroduce tidal connections to diked former Baylands, constructing new setback levees for flood protection, and grading filled areas to create new tidal channels, tidal wetland, ecotonal lowland terrestrial areas, and adjacent upland scrub habitat. Construction activities commenced in 2021 and completed construction in 2022. Regional ecosystem goals called for restoration of this type of habitat matrix and noted that opportunities for its creation are rare around San Francisco Bay's mostly developed shoreline. These habitats provide increased diversity and enhanced ecosystem functions under present day conditions and will sustainably evolve with future sea level rise.
Environmental Science Associates (ESA) surveyed for federal and state endangered California Ridgway's rail (*Rallus obsoletus obsoletus*) and state threatened California black rail (*Laterallus jamaicensis coturniculus*) from 2018 to 2025 in the project work area and surrounding tidal marsh using the Site-specific Protocol for Monitoring Marsh Birds. ESA documented California black rails colonizing restored marshes 2 years after construction, highlighting the importance of restoring diked wetlands and minimally subsided baylands for rapid recovery. The results also show the importance of surveys for listed wildlife post-construction to ensure restoration outcomes are relevant to the ecosystem.

Keywords: Restoration, black, rail, tidal, marsh, wetland, Suisun, habitat

Poster Topic: Species and Communities - Sensitive Species (including listed species)

Gray Whale Influx and Mortality in San Francisco Bay, 2018-2025

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Since 2018, we have observed a dramatic seasonal increase in the numbers of gray whales (Eschrichtius robustus) in San Francisco Bay (SFB). This influx into an urban habitat offered a unique opportunity where live whale sightings were available just prior to mortality and subsequent necropsy. The Marine Mammal Center collected sighting reports from whale watch naturalists and citizen scientists and conducted necropsies of stranded whales along with initiating a concerted photo-identification effort in 2023. Using these data, we compiled the first gray whale photo-identification catalog for SFB. Individual whale identifications were based on unique skin pigmentation patterns and scars, and resighting time frames ranged from days to months long. We then compared catalog photos of live whales to photos of deceased whale carcasses, a challenging methodology rarely successful due to decomposition and recumbency position. Field observations of whales, such as lateral body condition, could then be matched to measurements taken during necropsy, helping to validate health assessment techniques for live whales. A total of 50 carcasses were compared to 127 live whales sighted from 2018-2025. Of the 38 carcasses suitable for matching, 18 (47%) were matched to live whales observed in SFB. Notably, the number of live gray whale individuals identified in SFB was much higher in 2025 (n = 36 individuals) than 2023 (n = 17) or 2024 (n = 6), concurrent with a high mortality rate in the area (n = 20- over half the number of identified individuals). Determined causes of death included vessel strike and malnutrition. Our study period coincides with the most severe Unusual Mortality Event for gray whales, during which the population declined by 46%, and recovery remains uncertain. These observations inform future conservation and management strategies in a highly urbanized habitat with dense vessel traffic and highlight the importance of necropsy investigations.

Keywords: gray whale, mortality, vessel strike, methodology, photo-identification, necropsy, conservation management

Poster Topic: Species and Communities - Sensitive Species (including listed species)

Investigating Body Condition, Skin Condition, and Behavior of Gray Whales (Eschrichtius robustus) During Year of Record Presence in San Francisco Bay

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The majority of Eastern North Pacific (ENP) gray whales (Eschrichtius robustus) conduct a 10,000-mile roundtrip migration between summer feeding grounds in the Arctic to winter calving grounds in the lagoons of Mexico's Baja California peninsula. Despite being known for their nearshore migration path, there have not been frequent reports of gray whales in San Francisco Bay (SFB) except during Unusual Morality Events (UMEs: 1999-2001 and 2019-2023). The Marine Mammal Center initiated a photo-identification effort beginning in 2023, compiling a catalog of individuals that includes opportunistic photographs taken previously by community scientists and naturalists (2018-today). Following the closure of the most recent UME, SFB gray whale individuals and sightings decreased dramatically in 2024 (*n*=6). However, in 2025, outside of a declared UME, we recorded an unexpected increase in gray whale photo-identified individuals present (*n*=36), surpassing the previous record in 2019 (*n*=23: prior to dedicated effort), and coinciding with an increase in observations for many individuals. This study aimed to evaluate variation in body condition of whales in SFB in 2025, compare their body condition to whales observed in years prior, and evaluate behavior in relation to body condition. Our team reviewed images collected between 2018-2025 from all surveys and community submissions. In suitable images, subcutaneous fat was assessed in the postcranial, scapular, and lateral flank regions of the body and used as a non-invasive estimate of body condition (ranked poor, fair, or good). We also evaluated skin condition (i.e. ectoparasites, disease, injury presence), and individual behavior. Investigating body condition and behavior of gray whales present in SFB can provide insight into drivers of habitat use, overall ENP population health, and management needs. It will inform studies aiming to understand changes in gray whale migration phenology, and studies aiming to understand the impacts of climate change in Artic habitats on gray whales.

Keywords: Gray Whale, Body Condition, Photo Identification, Skin Condition, Eschrichtius robustus

Poster Topic: Species and Communities - Sensitive Species (including listed species)

Evaluating San Francisco Bay as Gray Whale (Eschrichtius robustus) Foraging Grounds Following an Unusual Mortality Event

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The majority of Eastern North Pacific (ENP) gray whales (Eschrichtius robustus) migrate from their breeding grounds in Baja California, Mexico to feed in the Bering and Chukchi Seas in Alaska. There are two well described groups of gray whales that are known to consistently feed south of the Arctic foraging grounds; The Pacific Coast Feeding Group (PCFG) feeds from northern California to southeastern Alaska, and the Sounders feed in Washington's Puget Sound. Since 2018, The Marine Mammal Center has documented gray whales annually using San Francisco Bay (SFB) during their northbound migration and is investigating their potential feeding group affiliation. An increase in observations within the Bay occurred during the most recent Unusual Mortality Event (UME), from 2019-2023. Following the UME closure, there was a notable decrease in individuals sighted in 2024. However, in 2025, we recorded an unexpected increase in identified individuals and observed behavior consistent with foraging. This study aims to examine the environmental conditions of SFB that may be relevant to foraging gray whales. Specifically, we reviewed information on SFB's benthic and epi-benthic organisms, substrate, and water properties. We then evaluated environmental trends prior to, during, and following the UME. We will compare these findings to environmental conditions in Alaska and common feeding grounds for the Sounders and PCFG to determine if conditions were favorable for gray whales foraging in SFB during their observed presence. Gray whales are considered flexible foragers, varying their distribution based on prey quality in their Arctic feeding grounds. Though prey may be available in SFB, separate studies should examine quality of prey items as this relates to distribution of whales in the Bay. These findings may illuminate which environmental conditions are predictors of gray whale presence and inform management strategies to mitigate anthropogenic impacts.

Keywords: Gray whale, benthic, invertebrates, habitat

Poster Topic: Species and Communities - General

State of the Conservation and Management of the Salt Marsh Harvest Mouse

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In the past several decades our understanding of the ecology of the State and Federally endangered Salt Marsh Harvest Mouse (SMHM) has evolved. No longer is the species perceived as an extreme habitat specialist, utterly dependent on pickleweed dominated tidal marsh. We now understand that the SMHM is a relative generalist within marsh habitat that feeds on a variety of plants and utilizes virtually all microhabitats within and adjacent to coastal marsh habitat in the San Francisco Estuary. This improved understanding of the species both improves and complicates potential conservation and management strategies for the species. A lack of pickleweed is no longer necessarily an indication of poor habitat value. Extensive uplands adjacent to tidal marsh may cause more harm than benefit to SMHM due to competition. High tide refugia islands on the marsh plain may provide little or no value to SMHM. Given the compromises that must be made during conservation and restoration planning for the endangered plants and animals of the San Francisco Estuary, ensuring that the ecological constraints of each species are accounted for is a daunting task. In this talk we will present a synopsis of the most recent discoveries in SMHM ecology, an overview of the putative species range, as well as a brief review of modern survey techniques. There has been relatively little investigation of the impacts of modern conservation actions (e.g., tidal restoration) on SMHM, likely due to cost and difficulty of surveys. This lack of monitoring has hindered our ability to gauge how effective various actions are. In light of this we will also address how advances in our understanding of SMHM ecology can inform and impact conservation and management strategies, from where to establish conservation areas, to what kinds of high tide refuge are likely the most effective for the SMHM.

Keywords: salt marsh harvest mouse, endangered species, tidal marsh, conservation, tidal restoration, ecology

Poster Topic: Species and Communities - Sensitive Species (including listed species)

Water Quality

Nutrient Attenuation Trend Observations in Lower South Bay

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Nutrient Attenuation Trend Observations in Lower South Bay
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Historically, the region of San Francisco Bay known as Lower South Bay (LSB) has had elevated concentrations of nitrogen relative to other estuaries due to the hydrology of the LSB and inputs of nitrogen via effluent from wastewater treatment facilities, stormwater runoff, and tidal exchanges through the Dumbarton narrows. The San José-Santa Clara Regional Wastewater Facility (RWF) significantly upgraded and optimized its treatment processes over the past 30 years, resulting in sharp reductions in nutrient loads to LSB. The RWF receives and treats wastewater from 1.5 million residents, more than 17,000 businesses, has a dry weather capacity of 167 MGD, and receives approximately 22,000 kg/d nitrogen from its service area. The RWF treatment process consists of screening, grit removal, primary sedimentation, advanced secondary biological nutrient removal (BNR), secondary clarification, tertiary filtration, disinfection, and de-chlorination. Tertiary treated final effluent is discharged to Artesian Slough, a tributary to LSB. Natural attenuation throughout the slough and LSB further reduces the LSB ambient nutrient concentrations.
RWF measures forms of nitrogen and phosphorus twice per month in the effluent and quarterly in the influent as required by the Nutrients Watershed Permit (NWP) for more than 10 years. Following a severe algal bloom event in 2022, the 2024 reissued NWP requires a reduction in nitrogen loading from wastewater treatment facilities to reduce the magnitude and likelihood of similar algal blooms from occurring. Since 2015, the RWF has conducted monthly nutrient monitoring at seven stations in the LSB along with measurements of dissolved oxygen, salinity, temperature, and pH. This poster analyzes RWF and LSB nutrient trends with respect to treatment optimizations, environmental changes, attenuation, and events.

Keywords: Nutrients, Wastewater, Biological Nutrient Removal, Attenuation, Nitrogen

Poster Topic: Water Quality – Nutrients

Does stratification drive harmful algal blooms in the Stockton Deep Water Channel?

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Harmful algal blooms are frequently observed in low energy, dead-end channels of the Sacramento-San Joaquin Delta. One such channel is the Stockton Deep Water Channel, which has routinely experienced large blooms of the toxic cyanobacterium *Microcystis* during the summer months. To investigate how the hydrodynamics of a low-energy channel may facilitate bloom initiation and support high phytoplankton biomass, the University of California Berkeley in collaboration with the U.S. Geological Survey conducted fieldwork during August 2024 around the terminus of the Stockton Deep Water Channel. We sampled the vertical distributions of phytoplankton alongside hydrodynamic parameters such as shear and temperature. We found that stratification heavily modulates wind-driven mixing during the day, but that stratification develops and breaks down on a diurnal cycle. This cycle was well-captured by an idealized one-dimensional water-column model. We simulate *Microcystis* in the one-dimensional water column model as a buoyant tracer with light-based growth and respiration parameterizations. Using this model, we explore how the duration and magnitude of stratification shapes *Microcystis* growth in the channel. Finally, we compare the physical conditions of August 2024 (which did not promote *Microcystis* bloom activity) to the conditions of June 2022 (during which the entire channel was overtaken by a harmful algal bloom), and discuss how these differences might inform future management changes.

Keywords: HABs, Microcystis, Delta, stratification, hydrodynamics, numerical modle

Poster Topic: Water Quality - General

Baseline Monitoring of Water Quality and Mercury from Fluvial and Estuarine Sources in Tidal Slough Habitats of South San Francisco Bay

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Consistent with the South Bay Salt Pond Restoration Project (SBSPRP) goals of tidal habitat wetland restoration, enhanced public access, and flood management, the Calabazas and San Tomas Creek Marsh Connection Project was awarded grant funding from the San Francisco Bay Restoration Authority, California Department of Fish and Wildlife and USEPA to re-establish fluvial and tidal connections between estuarine and riverine habitats as well as former Salt Ponds in the Alviso complex (Ponds A4, A5, A7, and A8).
Valley Water undertook mercury and water quality baseline monitoring efforts in 2023 and 2024 to address key uncertainties related to the potential for Project-related altered water quality conditions, mobilization of legacy mercury deposits, and changes in methylation and bioaccumulation of disturbed mercury. While existing studies by the United States Geological Survey, University of California at Davis, and others guide expectations, 2023 and 2024 additional monitoring informs a baseline for unique features of the Project.
Data characterizing seasonal in situ water quality follow expected tidal patterns at slough (Guadalupe, Alviso, Mallard) and pond (A8, A4, A17) sites, with apparent seasonal variability that may affect mercury methylation potential. Mercury concentrations are generally highest in Pond A4 water and biota relative to sites in Guadalupe and Alviso sloughs and the A8 ponds, including control sites. The northern end of the A8 ponds occasionally exhibit higher surface water and phytoplankton mercury concentrations than other sites (not including Pond A4), although this did not persist at higher trophic levels, suggesting short-lived pulses of methylmercury too limited to support increases in bioindicator mercury levels. Baseline results are considered relative to existing studies, Project restoration alternatives, and planned restoration activities.

Keywords: Biota, Methods, Mercury, Restoration, SBSPRP, Sediment, Tide, Tidal, Turbidity

Poster Topic: Water Quality - General

Metal Bioaccumulation Patterns in Mollusks: A Literature Review

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Mollusks are a diverse group of animals that inhabit metal-contaminated environments and are frequently used as bioindicators of metal contamination. The accumulation of metals in molluskan tissues can vary among species, based on the life history traits, a phenomenon that has not been empirically studied until now. In this study, we compiled a dataset of 156 molluskan species from 178 published documents, examining how the accumulation of copper (Cu), zinc (Zn), cadmium (Cd), lead (Pb), and mercury (Hg) varied with life history traits, employing a sophisticated phylogenetic comparative analysis approach. We explored the patterns of metal bioaccumulation in response to environmental metal doses using a bivariate linear model. We also used an ANCOVA model to compare these patterns among different molluskan classes, salinity tolerances, feeding modes, reproductive strategies, ecotypes, and modes of mobility. The analysis revealed a positive linear relationship between soft tissue concentrations of all targeted metals and sediment metal concentrations ($p < 0.05$, $R^2 = 0.04$ to 0.32), indicating that mollusks can be effective bioindicators of metal contamination. ANCOVA analyses revealed *Gastropoda* had greater tissue metal accumulation at lower exposure concentrations than *Bivalvia* and *Cephalopoda*. Conversely, *Bivalvia* exhibited higher Cu, Zn, Pb, and Hg accumulation at elevated sediment metal levels, while *Cephalopoda* displayed the least metal accumulation, regardless of sediment concentration. Tissue Cu accumulation varied significantly among mollusks, with different salinity tolerances. Notably, brackish water species exhibited higher Cu, Zn, and Hg accumulation at increased sediment concentrations. No differences in metal accumulation were observed for taxa with different feeding modes, reproductive methods, ecotypes, and mobility patterns, due to variability in metal accumulation and dose among taxa within each group. These analyses demonstrate the influence of biological traits on metal accumulation and have practical applications for selecting the appropriate species for metal biomonitoring.

Keywords: metals, mollusks, mollusca, bivalves, mercury, copper, salinity, life history, bioaccumulation

Poster Topic: Water Quality - General

Fate of PFAS in Horizontal Levees Treating Municipal Wastewater

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Potable water reuse projects often employ reverse osmosis as a means of removing chemical contaminants and pathogens. This results in the production of large volumes of water that contain relatively high concentrations of salts, organic matter and trace organic contaminants. These constituents, which include trace organic contaminants, like PFAS, are often about five times more concentrated than levels found in treated wastewater. To provide a nature-based approach for removing PFAS from this concentrated waste and wastewater effluent, we studied a pilot-scale subsurface wetland. Subsurface flow constructed wetlands contain microbes associated with decaying organic matter (e.g., decaying plant roots, added wood chips) and minerals. To enhance the treatment capacity of a subsurface wetland, we amended several wetland cells with activated carbon or a functionalized clay. Initial data indicate that PFSAs and long-chain PFAS are well-retained in the subsurface, while PFCAs and short-chain PFAS break through rapidly. The total oxidizable precursor assay has been employed to evaluate the potential for PFAS precursor transformation in a horizontal levee, which is critical to understand because PFAS precursors can make up 20-50% of total PFAS mass in treated wastewater. Data from this system help advance knowledge on PFAS fate in the subsurface environment and provide evidence that modified nature-based treatment systems can be an effective means of preventing PFAS discharge to the environment.

Keywords: PFAS, Wastewater, Nature-Based Wastewater Treatment, Potable Water Reuse

Poster Topic: Water Quality – Emerging Contaminants

From Stormwater to Safe Seafood: Tackling PCBs in the San Francisco Bay

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The San Francisco Bay (Bay) supports a diverse and dynamic ecosystem and the economy of the region. The Bay is named in the federal Clean Water Act as one of 28 "estuaries of national significance." PCBs are widespread across the urban areas draining to the Bay, but are concentrated in the historic industrial areas along the Bay margin that supported the region's growth throughout the 20th century. The health of community members is directly impacted by the presence of PCBs, and subsistence fishers who reply on Bay fish to feed their families are disproportionately affected. The San Francisco Bay Regional Water Quality Control Board adopted a PCBs Total Maximum Daily Load (TMDL) in 2008. Urban stormwater runoff is one of the sources/pathways identified in the PCBs TMDL. The TMDL requires a 90 percent load reduction by 2030 for urban stormwater, relative to the estimated load in 2003. The Bay Area countywide stormwater programs implement source and treatment control measures to reduce PCBs in urban stormwater runoff. The programs also implement a fish risk reduction program to reduce health risks in people most likely to consume Bay-caught fish. This presentation will describe these control measures and desired outcomes.

Keywords: Total Maximum Daily Load, Polychlorinated Biphenyls, Stormwater, Urban Runoff

Poster Topic: TMDL Implementation

Watershed-Level Planning for Sustainable Water Resource Management in Santa Clara County

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The health of Santa Clara County's watersheds is intertwined with the health of the San Francisco Estuary. Improving ecological conditions in these upstream areas contributes directly to Estuary-wide sustainability, fulfilling the integrated vision of the Estuary Blueprint for connected and ecologically vibrant watershed-to-Bay systems. However, these upstream areas face escalating challenges from aging infrastructure, climate change, and increasing pressures on water quality and supply. These challenges necessitate a shift to holistic, watershed-scale management strategies that recognizes the interconnectedness of water, ecosystems, and communities.

To address these needs, Valley Water is developing comprehensive Watershed Master Plans for each of Santa Clara County's five major watersheds. The plans assess current conditions, use a data-driven approach to identify management gaps, and prioritize multi-benefit projects. Valley Water works with the San Francisco Estuary Institute to develop and maintain a customized profile tool on EcoAtlas where watershed health metrics are publicly available and tracked over time. Central to this effort is collaboration with municipalities, regulatory agencies, and a diverse community network to co-create solutions tailored to the distinct features of each watershed.

Complementary to the Estuary Blueprint, the Watershed Master Plans identify actions needed for healthier habitats and wildlife, increased climate resilience, and improved water quality within the watersheds local to Santa Clara County. Three of the five Watershed Master Plans are complete. Actions identified in these plans are underway such as projects that improve steelhead passage, extend wildlife corridors, reduce flood risk, study sediment reuse, mitigate for climate change, and more. Valley Water is now working on completing the final two plans which are for the West Valley and Lower Peninsula watersheds. Combined, these plans support both near-term environmental gains and long-term sustainability goals outlined in the Estuary Blueprint, helping to secure the future of both upstream communities and the greater Estuary ecosystem.

Keywords: Ecosystem-based management, watershed stewardship, flood protection, adaptation

Poster Topic: Watershed Management

Geochemical lessons learned from a 10-year investigation of a small Oakland watershed-lake-creek system

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Climate change, historic mines, and urban development are continuing pressures on watersheds, creeks, and associated reservoirs that drain to the San Francisco Bay (SFB). Ephemeral reservoirs may be important controls on pollutant cycling and downstream water quality in urban watersheds. We studied a small Oakland SFB watershed/reservoir system (Leona Creek/Lake Aliso on the Mills College at Northeastern University campus) to assess how reservoir management may mitigate or exacerbate contaminant discharge to coastal urban environments during drought (2012-2016) and post-drought (2016-2022) conditions. We collected and analyzed standard geochemistry, nutrients, and trace element (e.g., Mn, Ni, Cu, Zn, As, Cd, Pb) levels from water in the reservoir, reservoir inlet, and reservoir outlet on a bimonthly basis from 2012 to 2022. Inlet metal concentrations (e.g., Mn, Ni, Cu) were generally higher than outlet concentrations. Reservoir stratification varied over the course of a year and led to reducing conditions prevailing during warm dry summer months and oxidizing conditions dominating during cool wet winter months. During the low flow summer/fall seasons, reducing conditions in the reservoir expanded. Interestingly, we found that inlet metal concentrations to the lake were similar for wet and dry seasons, but outlet metal concentrations were significantly lower during dry low flow seasons (lake present) than wet high flow seasons (lake absent). Therefore, it's likely that the presence/absence of the reservoir, the redox state of the reservoir, and other factors such as amount of organic material determine whether metals are mobilized downstream to the SFB or retained by the reservoir. While this individual system may have little impact on the SFB, we hypothesize that collectively the management of small watershed-reservoir systems could influence SFB water quality.

Keywords: geochemistry, watershed, reservoir, management, metals, nutrients, Oakland, creek, climate change

Poster Topic: Watershed Management