Suisun Marsh: California's Largest Marsh and Its Connection to Suisun Bay

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Suisun Marsh supports many beneficial uses, centered around recreation (mainly hunting, fishing, wildlife observation) and resident and migratory species support. Covering 100,000 acres, Suisun combines 52,000 acres of diked wetlands managed mostly for waterfowl hunting, 22,000 acres of shallow bays and 3,000 acres of sloughs used for fishing and supporting numerous fish and wildlife species, 8,000 acres of tidal marsh supporting a variety of fish and wildlife species and several listed plant species, and 16,000 acres of surrounding uplands. Suisun is a core region supporting several listed fish species, both resident such as Delta and Longfin Smelt and migratory such as Chinook salmon. These beneficial uses face several challenges, most notably: salinity levels linked to Delta outflow, invasive aquatic and terrestrial species, water quality impairments from legacy and ongoing land uses, sea level rise and warming waters, and regional declines in sediment supply. Within Suisun, efforts are underway to improve duck club operations to improve impaired water quality, restore tidal marsh to restore fish, plant and wildlife habitats and their associated functions and services, the Regional Board is developing TMDLs to address water quality impairments, and SRCD coordinates wide-ranging improvements to diked wetlands to address beneficial uses and impaired water quality. Suisun also holds one of the region's two National Estuarine Research Reserve sites – Rush Ranch – which provides a focal point for wetland-oriented applied research including listed species recovery and carbon sequestration. Several entities have ongoing fisheries and aquatic ecology research, helping to elucidate opportunities for improving beneficial uses through tidal marsh restoration and diked wetland management, including illuminating complexities around restoring shallow water habitats and "mature" emergent tidal marsh for their ecological functions and ecosystem services. The 2017 winter illustrated the value of high Delta outflow to Suisun beneficial uses, alongside levee failure hazards those flows cause.

Keywords: Suisun, diked wetlands, tidal marsh, TMDL, water quality, beneficial uses

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Speaker Biography: Dr. Stuart Siegel is the Coastal Resilience Specialist for the San Francisco Bay National Estuarine Research Reserve, Adjunct Professor of Earth and Climate Sciences at San Francisco State University, and Principal of Siegel Environmental. He focuses on the intersections of climate change, natural resources resiliency, ecosystem restoration, management-relevant science, and regional planning. Dr. Siegel leads the Suisun Low Dissolved Oxygen improvement implementation study. He has lead design teams for several wetland restoration projects responsive to climate change, including Aramburu Island, Sonoma Creek, and Sears Point. He was a co-lead scientist for DRERIP, technical lead for the Delta Vision Ecosystem Workgroup, Suisun Marsh Plan Science Advisor, and lead PI for the Integrated Regional Wetland Monitoring Pilot Project. He co-authored the Wetland Carbon Sequestration Road Map to Implementation, authored the climate change chapter of the Moyle Suisun Marsh book, and served on technical advisory panels for large restoration projects.

Are Fish Kills a Thing of the Past? Improving Dissolved Oxygen in Suisun Marsh

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Suisun Marsh, the largest contiguous brackish water marsh remaining on the West Coast continues to be a managed resource. It was protected from urban development in the 1970s. The focus of its ongoing protection has been as habitat for waterfowl and wildlife. While it remains a large wetland today, there are ongoing water quality concerns due to diking and periodic discharges from managed duck ponds which have caused low dissolved oxygen (DO) concentrations (between zero and two mg/L) in some slough channels, and have been associated with fish kills in the past. The San Francisco Bay Water Board is in the process of developing a Total Maximum Daily Load (TMDL) also referred to as a water quality attainment strategy. The focus of the TMDL is on implementation of management practices to improve water mixing and timing of discharges to prevent the adverse impacts of low DO on fish and aquatic life. Thus far, early-implementation of TMDL best management practices have yielded substantial improvements in water quality conditions. A component of this project includes development of DO objectives specific to slough channels. DO objectives were established in the San Francisco Bay Basin Plan in 1975. This is the first effort the Water Board has embarked upon to evaluate the appropriateness of its DO objectives. It involved evaluating the sensitivity and oxygen requirements of Suisun Marsh fish and application of the U.S. EPA approved Virginian Province Approach to develop chronic and acute DO objectives. The approach taken to develop site-specific objectives for Suisun Marsh sloughs is likely applicable to other marsh slough channels in the Bay.

Keywords: Suisun Marsh, water quality, dissolved oxygen, site-specific objectives, TMDL

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Speaker Biography: Barbara has been with the Planning and TMDL section of the Water Board for the past 11 years. Before, she worked for 7 years for the Environment Protection Authority in Sydney, Australia. Barbara holds a PhD in Earth Sciences from Warsaw University in Poland.

Juvenile Fish Nurseries in Emergent Tidal Marshes of Suisun Marsh

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Coastal and estuarine nearshore habitats provide essential habitat for juveniles of fish species that make ontogenetic shifts to adult populations. We investigated the role of emergent tidal marsh in providing fish nursery habitats in Suisun Marsh, located in the upper San Francisco Estuary. Using a long-term otter trawl and beach seine data set (1995-2016), we asked, 'Do species partition juvenile rearing habitats in space and time?' and, 'What factors contribute to juvenile habitat use in reference and modified tidal wetlands?' We found that the three most abundant species (Striped Bass, Sacramento Splittail, and Tule Perch) consistently used the reference tidal marsh for juvenile rearing, but displayed different patterns of peak abundance throughout the spring/ summer recruitment window. Modified tidal marshes also supported juvenile rearing where terminal sloughs shared similar features as the reference site, including complex topography, geomorphology, and connectivity to upland watersheds. We propose that, in addition to providing resilience to sea level rise, shallow estuarine aquatic-emergent marsh-upland transition ecosystem complexes represent contiguous habitats (i.e., core patches and surrounding corridors) that together enhance aquatic food webs and benefit juveniles of many fish species. We recommend priority areas in Suisun Marsh where tidal marsh restoration and connectivity to upland transition zones are more likely to support juvenile fish recruitment into the uncertain future.

Keywords: tidal marsh, fish, ecology, connectivity, restoration

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Speaker Biography: Denise Colombano is a PhD Candidate and Delta Science Fellow conducting research at the Center for Watershed Sciences at the University of California, Davis. She studies fish ecology in conjunction with the Suisun Marsh Fish and Invertebrate Study in Dr. Peter Moyle's laboratory.

Selenium in Suisun Bay – Tracking Change Post-TMDL

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Suisun Bay is a focal point for selenium concern in the Estuary due to the abundance of the non-native overbite clam (*Potamocorbula amurensis*) and it being a preferred habitat of a sensitive fish species: white sturgeon (*Acipenser transmontanus*). The San Francisco Water Board established a total maximum daily load (TMDL) control plan for selenium in the North Bay in 2016, with the goal of preventing increases in the food web. The TMDL established targets for selenium in white sturgeon and in water. Monitoring is needed to provide a robust dataset for evaluating whether the targets are met, to ensure that concentrations do not increase, and to assess the potential impact of changes in selenium inputs to Suisun Bay from the Delta as a consequence of Delta water management or other management actions in the Central Valley. The Regional Monitoring Program for Water Quality in San Francisco Bay (RMP) is developing a monitoring plan for sturgeon, water, and clams to track trends, with a special emphasis on early detection of change. The U.S. Geological Survey has generated a robust 20-year dataset on trends in concentrations in clams. The RMP has also conducted monitoring of trends in white sturgeon for 20 years, but with a limited sampling intensity. The long-term clam dataset indicates that high Delta outflow has been correlated with lower selenium concentrations in North Bay clams. Clam concentrations were relatively high during the 2012-2016 drought, and levels in sturgeon muscle in 2015 and 2016 were also relatively high and more frequently above the TMDL target. The extremely high freshwater flow during the wet season of 2016/2017 is expected to lead to lower concentrations in clams, which should also lead to lower concentrations in the white sturgeon tissue that will be collected by the RMP in the fall of 2017.

Keywords: Suisun Bay, selenium, sturgeon, clam

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Speaker Biography: Dr. Jay Davis grew up near the PCB-contaminated aquatic food web of Lake Michigan. He has worked on contaminant issues in San Francisco Bay since 1986. He received his Ph.D. in Ecology at the University of California, Davis in 1997. Dr. Davis is Lead Scientist of the Regional Monitoring Program for Water Quality in San Francisco Bay, a comprehensive water quality monitoring program. He is also lead scientist for the Bioaccumulation element of the California State Water Resource Control Board's Surface Water Ambient Monitoring Program, which conducts statewide surveys of contaminants in aquatic food webs. Dr. Davis is also the co-Director of SFEI's Clean Water Program. His primary research interests are monitoring the accumulation of persistent contaminants in aquatic food webs of the Bay, its watershed, and aquatic ecosystems in California; and the work of John Lillison, England's greatest one-armed poet.