State of the Estuary Report 2015: Freshwater Flows

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In the San Francisco Bay estuary, the amounts, timing and patterns of freshwater inflows control the quality and quantity of estuarine habitat, drive key ecological processes, and significantly affect the abundance and survival of estuarine biota, from tiny planktonic plants and animals to shrimp and fish. The State of the Estuary report uses more than a dozen indicators to measure and evaluate the condition and trends over time of annual and seasonal inflows, the quality and quantity of open water habitat, and the frequency, magnitude and duration of flood-driven ecological processes. Indicator results were compared against benchmarks, or reference conditions, that were based on scientific literature on environmental flow requirements for riverine and estuarine ecosystems, statistical relationships between inflows and estuarine habitat and fish abundance and survival, the State Water Board's 2010 Flow Criteria report that identified flows needed to protect public trust resources, historical inflow conditions, and regulatory standards for inflows, Delta diversion levels, and water quality. The Freshwater Inflow indicators revealed that inflows have been substantially reduced, averaging just half of estimated unimpaired inflows and creating chronic, man-made drought conditions in the estuary. These lower inflows result in reduced frequency of occurrence and quality of open water habitat conditions in the Delta (upper estuary) and the Bay, and reduced frequency of occurrence, magnitude and duration of ecologically important high flow flood conditions. Since 1990, most of the Freshwater Inflow indicators show "poor" and deteriorating conditions, and the Open Water Habitat and Flood Events indicators show that these ecological attributes were in "poor" condition in most years and only rarely in "good" condition (20% of years or less). These results underscore the importance of improving freshwater inflow conditions to the estuary as an essential element of ecosystem protection and restoration efforts.

Keywords: freshwater inflow, open water habitat, flood events, indicators, Bay, Delta

Session Title: State of the Estuary Report 2015: How Healthy is Our Estuary?

Speaker Biography: Christina (Tina) Swanson, Ph.D., is Director of the Natural Resources Defense Council's Science Center, where she works to expand the organization's scientific capabilities and support its legal and policy work across a range of environmental, public health and sustainable management issues. Prior to joining NRDC in 2011, Tina worked with The Bay Institute, serving as the organization's fisheries scientist and, from 2008-2011, as Executive Director and Chief Scientist. She is an expert in biology, ecosystem protection and restoration, ecological indicators and water resource management. Much of her work has been in the San Francisco Bay-Delta, but she has also worked and conducted research in Hawaii and, as a Fulbright Scholar, in the Philippines. Tina received her B.A. from Cornell University, her doctorate from UCLA and conducted post-doctoral research at UC Davis. She was President of the Western Division of the American Fisheries Society in 2012-2013.

State of the Estuary Report 2015: Habitat

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This two-part presentation covers three indicators of estuarine habitat health included in the State of the Estuary Report. The first part covers tidal marsh extent and patch size. Although the historical (pre-Euro-American) area of tidal marsh was greater in the Delta than the Bay, as of 2009 there were 12 and 70 mi^2 of the habitat in the two regions, respectively. Since then, an additional 0.4 and 10 mi^2 of diked areas have been restored to tidal action. The current proportion of Bay tidal marsh habitat arranged in patches large enough to support key native species, specifically rails, is comparable to historical levels. In the Delta, however, this proportion has been drastically reduced, further highlighting disparities between the two regions in the status of tidal marsh habitat. Given common assumptions of sea level rise and upstream salinity-shifts, these results signal the need for Estuary-wide habitat restoration goals. The second part of this presentation covers migration space, which is the area into which the rising Estuary could migrate. A basic approach to consistently characterize migration space has been tested, given four criteria: Bay-Delta applicability; reliance solely on public data; upgradability, and adjustability of key parameters. Based on a changeable definition of undeveloped lands, the approach reveals that, for a 2-ft rise in the Estuary, there is about 100 mi^2 of migration space, of which less than 30% is undeveloped. Only about 9% of the total migration space is both undeveloped and protected. In order of deceasing percentage of protected-undeveloped migration space, the sub-regions are: North Bay, Central Delta, Suisun, North Delta, South Bay, Central Bay, and South Delta. The North Delta, Central Delta, and South Bay have the three largest areas of unprotected-undeveloped migration space. Further analysis using local data in a regional context will facilitate migration space planning.

Keywords: tidal marsh, migration space, San Francisco Bay-Delta Estuary, SOTER

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Speaker Biography: Sam Safran is an Environmental Analyst in the Resilient Landscapes Program of the San Francisco Estuary Institute. He is the author of the tidal marsh and woody riparian habitat sections of the 2015 State of the Estuary Report. He also carried out the spatial analyses of landscape change in the Sacramento-San Joaquin Delta that were recently published by SFEI in the report "A Delta Transformed."

State of the Estuary 2015: Living Resources and Food Web

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The San Francisco Estuary provides essential habitat for a diverse community of fish, wildlife, invertebrates, and plants that depend on the Estuary to complete all or part of their life cycles. In a comprehensive effort to assess the health of these populations in the Estuary, more than 30 Living Resources and Food Web indicators were developed for the State of the Estuary Report 2015. Results were evaluated with reference to benchmark conditions, which allowed assessment of current status and trends over time. Many indicators were updated from the 2011 Report and other indicators were added to extend the spatial coverage to include Suisun Marsh and the Delta, and to broaden ecological representation.

Status and trends differed regionally as well as among and within groups of organisms. The diversity of results reflects underlying differences in the ecology of estuarine species and their responses to ecological stressors. Fish indicators, including abundance of native fish, diversity, and community composition, suggested better conditions in the Central Bay, which is more influenced by ocean conditions, and poorer conditions in the upper Estuary region, which is more influenced by freshwater flows. Most of these fish indicators exhibited declining trends. The results for Delta and Suisun Marsh aquatic invertebrate and fish food web indicators were “good” to “poor,” with trends in overall and native species abundance varying among regions. Wintering and breeding waterfowl indicators were “good” to “poor” and showed mixed trends. Many of the bird and mammal indicators, such as harbor seals, herons and egrets, revealed relatively stable trends, though large shorebirds evidenced substantial declines. Some bird species (e.g., Brandt’s Cormorants) demonstrated recent recovery from earlier declines.

The Living Resources indicators set the stage for tracking ecosystem improvements as habitat restoration proceeds. In some cases (e.g., tidal marsh birds) they are already providing evidence of improvement.

Keywords: Fish, food web, birds, health, Delta, Bay, Suisun, indicators, wetlands

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Speaker Biography: Nadav Nur is currently Quantitative Ecology Program Director at Point Blue. He has led the Bird and Mammal component of the 2015 State of the Estuary Report. **Hildie Spautz** is a Scientist with the California Department of Fish and Wildlife’s Watershed Restoration Grants Branch, where she participates in development of monitoring and adaptive management plans for restoration programs, primarily in Delta wetlands. As a scientist for the Rivers and Delta Program at The Bay Institute, **Alison Weber-Stover** collaborates on research projects aimed at understanding and improving ecosystem health of the San Francisco Estuary and its watershed.

State of the Estuary Report 2015: Water Use and Re-use

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WATER USE: This indicator measures the total volume of potable water annually used by municipalities in the Bay Area from 1986 to 2014 and the amount used per-person on an average daily basis (gallons per capita per day –gpcd) for the same period. Potable water use from 1986 to 2014 declined 24% or 266 thousand ac-ft from its near historical peak use of 1.1 million ac-ft. This is a remarkable achievement given that the population increased 26% during the same period. The per-person use declined by an even greater percentage - 40% down to 119 gpcd- because of the population increase. Residential use declined 16% or 93 thousand ac-ft (TAF) during this same period and the per-person use declined 33% to 72 gpcd by 2014. Data from 2014 and the first half of 2015 suggest that the region should be able to meet drought-induced mandatory use reductions imposed by the State and local agencies.

RECYCLED WATER: Recycled water is quantified with two metrics: 1) the total of the highly treated water distributed from wastewater treatment plants (WTPs) to provide a beneficial use, and 2) the surface and ground water supply that it potentially offsets, i.e. water that otherwise would be treated to potable (drinking water) standards and delivered by a municipal supplier or self-supplied groundwater or surface water that an agricultural or other commercial user would consume (potentially available for potable use). Recycled water use was quantified for 2001, 2005, 2010, and 2014. Total use steadily grew from 2001 to 2014 by 23 TAF, an 80% increase, to 52 TAF, which represents about 9% of the wastewater produced at WTP's. The amount that offsets potential potable water grew more - 26 TAF or a 158% increase- up to 42 TAF, which represents about 5% of the urban demand in 2014.

Keywords: potable water, recycled use, Bay Area per-capita, municipal beneficial wastewater

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Speaker Biography: Peter Vorster has over 40 years of experience as a hydrogeographer, much of it focused on California's water resources. Peter has been at The Bay Institute since 1996, where he heads up the San Joaquin River Restoration Initiative and is a principal for the Ecological Scorecard project. Currently he is a senior adviser to the California Water Foundation on their Sustainable Water Management Profile project. Peter's expertise includes water management, water balance and system operations modeling, stream restoration, historical landscapes of California, and museum education. Peter is also a consultant to groups working on stream restoration and environmental flow management, primarily in the Eastern Sierra. He has an A.B. in geography and geology from UC Berkeley, an M.A. in geography from California State University East Bay, and completed Ph.D. coursework in environmental planning at UC Berkeley.