Technical Report 571

Status of Perennial Estuarine Wetlands in the State of California: Final Report to the Surface Water Ambient Monitoring Program State Water Resources Control Board

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EXECUTIVE SUMMARY

Section 305(b) of the Federal Clean Water Act (CWA) requires each state submit biennial reports describing the health of its surface water, including wetlands, to the USEPA. This document reports on the health of California's perennial, saline estuarine wetlands.

Estuaries are partially enclosed bodies of water along the coast where freshwater runoff meets and mixes with salt water from the ocean. Based on the draft definition of wetlands for California, an estuarine wetland is an area within an estuary that is exposed at low tide and covered with rooted vegetation.

The health of the state's estuarine wetlands is estimated from a statewide survey of the distribution, abundance, and ambient condition of estuarine wetlands. The survey had three components: 1) landscape profile; 2) probability-based assessment of ambient condition; and 3) assessment of selected estuarine wetland restoration and mitigation projects. The results help answer four fundamental management questions: 1) where *are* the State's estuarine wetlands and how abundant are they; 2) what is the ambient condition of estuarine wetlands statewide and how does their condition vary by region; 3) what are the major stressors and how do they vary among coastal regions; and 4) what is the condition of permitted restoration projects relative to ambient condition. This fourth question demonstrates how data could be used to evaluate policies and programs affecting the distribution, abundance, and condition of estuarine wetlands.

The landscape profile described the distribution and abundance of the State's estuarine wetlands relative to other estuarine habitats and explored the underlying causes through a detailed examination of trends in San Francisco Estuary. A probability-based survey was used to assess the ambient condition of saline, perennial estuarine wetlands. The statewide ambient survey involved 120 sites allocated equally among four regions: North Coast, San Francisco Estuary, Central Coast, and South Coast. An additional 30 sites were allocated to South Coast to test for a difference between large and small estuaries. The field survey was conducted in the Fall of 2007. The statewide ambient survey in turn served as a regional frame of reference for project assessments.

Both the ambient survey and the project assessments utilized the California Rapid Assessment Method (CRAM; Version 5.0.2). CRAM is a field-based method to assess wetland condition based on visible indicators of four wetland attributes: Landscape Context, Hydrology, Physical Structure, and Biological Structure. Results were reported as the percent of the total area of estuarine wetland in California likely to fall within four categories equally-spaced categories of possible CRAM index or attribute scores, which range from 25-100: Scores greater than 82 = Category 1; scores between 63 and 82 = Category 2; scores between 44 and 63 = Category 3; and scores less than 44 = Category 4.

Landscape Profile. Approximately 91% of the historical amount acreage of California wetlands has been lost due to reclamation and land use. Accurate estimates of estuarine wetland loss in particular are only available for the San Francisco Estuary. In spite of losing approximately 85% of its saline wetlands and almost 92% of its freshwater tidal wetlands, the SF Estuary has almost 44,500 acres of estuarine wetlands at this time, about 77% of all the estuarine wetlands in the state. Although land use varies among the estuaries of California, it has affected the distribution, abundance, size, and shape of estuarine wetlands in consistently deleterious ways. It has decreased the amount of estuarine wetland and increased the number of small wetlands, thus increasing the distance between wetlands. In the more urbanized estuaries of the South Coast, Central Coast, and SF Estuary, many wetlands are embedded in intensive land uses and bounded by levees. These conditions diminish the hydrological and ecological connectivity among the wetlands, increase their susceptibility to invasion and local catastrophic events, and reduce their overall capacity to serve society.

Ambient Survey. An estimated 85% of the State's saline estuarine wetland scored within the top 50% of possible CRAM index scores. The statewide results are strongly influenced by the SF Estuary, which has most of the saline estuarine wetland. Landscape Context was the attribute for which the State's estuarine wetlands scored the highest. The CRAM Landscape Context consists of indicators of aquatic connectivity and natural buffer size and condition.

With regard to Landscape Context, an estimated 64% of the total acreage of estuarine wetland was in the top category of CRAM scores. This is a reflection of the relatively large size of SF Estuary wetlands and their more rural context. With regard to Hydrology and Biological Structure, an estimated 35% of the State's estuarine wetland acreage scored within the top category of CRAM scores. The CRAM Hydrology attribute is about freshwater source, hydrologic connectivity, and hydroperiod, while the Biological Structure attribute is about plant community composition, vertical vegetation structure, and horizontal zonation and interspersion of plant species or assemblages. Urbanized estuaries tend to have smaller wetlands with lower Hydrology and Biotic Structure health scores.

The State's estuarine wetlands scored lowest for the Physical Structure attribute, which is about the topographic complexity of a wetland and its diversity of physical patch types (e.g., pannes, pools, channels etc.). For this attribute, an estimated 62% of the acreage scored in the lower 50% of possible CRAM scores. Non-natural tidal and freshwater hydrology and excessive sediment supplies have reduced the physical complexity of wetlands in South and Central Coasts and San Francisco Estuary The presence of dikes, levees, and other water control structures that restrict tidal exchange is significantly correlated to poor wetland health.

CRAM index and attribute scores showed a general decrease from north to south. This difference was most pronounced for Hydrology and Physical Structure (25 - 30 point difference from North to South Coast) and least pronounced for Landscape Context (difference <10 point). This north-south gradient in condition tracks a similar gradient in density or extent of urbanization. While the general negative correlation between wetland condition and adjacent land use is clear, the corrective measures will vary with the particulars of local land use history and practice. Regional differences must be interpreted carefully because of inherent natural variability.

Project Assessments. Project assessments demonstrate how the condition of estuarine wetland projects can be assessed by comparing them to the ambient condition of comparable wetlands. The assessed projects include impact sites from development activities, mitigation sites resulting from compensatory mitigation, and non-regulatory wetland creation, restoration or enhancement sites. The project health scores tended to be 5 - 20% lower than the ambient scores for their regions, with the difference most pronounced for South Coast. The low scores for projects could be attributed to various factors: projects tend to be smaller, younger (less developed), and more closely associated with developed landscapes.

Suggested Management Actions and Other Recommendations. Within each region, CRAM scores and the stressor checklist suggest possible management actions to improve wetland health. The stressors affecting the condition of estuarine wetlands originate in their watersheds or adjoining uplands. In urbanized areas, decreases in water supplies due to upstream withdrawals or increases due to urban runoff have altered estuarine salinity regimes. In some estuaries, erosion control or impoundment of sediment has significantly reduced the amount needed to sustain estuarine wetlands. In other areas, such as the North Coast, timber harvesting activities upstream have led to excessive sedimentation. In all regions, conversion of floodplains to developed land use has reduced their abilities to filter runoff and buffer estuaries from upstream contaminants. Better management of urban and agriculture runoff through integration of Best Management Practices is necessary to reduce contaminant inputs to these systems, reduce toxicity of water and sediments and to improve flood control. Expansion of restoration within the upstream reaches of estuaries will reduce the stresses downstream.

Improving biological conditions in the North Coast region requires controlling the invasive cordgrass *Spartina densiflora*. Its intermediate dominance in many wetlands increases their structural complexity, but this will probably decrease as the dominance increases. Many North Coast estuarine wetlands are unlikely to attain higher conditions of species richness or biological structure unless this invasion is controlled.

Historical levees and dikes modify tidal circulation and thereby cause a general decline in estuarine wetland condition. Much of the infrastructure that adjoins estuaries, including operational and abandoned railroads and highways, occupies levees or other engineered fills that cross intertidal areas. Careful removal, realignment, or re-engineering of these crossings is required so that they no longer impede tidal circulation. Many of these crossings will need to be modified to accommodate rising sea levels and increased wave run-up; improved tidal exchange between estuarine wetlands and their estuaries should be linked to infrastructure repair and replacement as a design criterion.

Estuarine wetlands should be regarded as downstream extensions of local watersheds. Improving the overall condition of estuarine wetlands will ultimately require changes in watershed management to assure adequate supplies of clean water and sediment, improved tidal circulation between the wetlands and their estuaries, and adequate lands to accommodate estuarine transgression due to sea level rise.

One of the objectives of this assessment was to establish a baseline against which future landscape profiles could be compared. However, a comprehensive base map of one vintage and adequate precision and accuracy to meet local and state needs has proven to be very difficult to develop once, and is likely to be more difficult to replicate. For this reason, it is recommended that the state adopt the sampling approach used by the National Wetlands Inventory NWI Status and Trends (ST) assessments. For the national assessment being planned for 2011, 40-60 ST plots have been allocated to California estuarine habitat. This is likely to be an inadequate sample size to re-assess the distribution and abundance of estuarine wetlands within the State of California. The state should consider intensifying the proposed survey with additional ST plots. The existing comprehensive base map of estuarine wetlands produced for this report could be used to calculate the relationship between sample size and accuracy of the profile, as needed to identify the optimal number of ST plots.

Networks of reference sites that illustrate the full range of conditions for each CRAM attribute and metric should be established for each region of the state. Such networks are essential for refining CRAM, establishing quality assurance standards, and training CRAM users.

Full Text

ftp://ftp.sccwrp.org/pub/download/DOCUMENTS/TechnicalReports/571_PerrenialEstuarineWetlands.pdf