

Nutrients in San Francisco Bay: Science to Inform Policy

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San Francisco Bay has long been recognized as a nutrient-enriched estuary, but one that has exhibited resistance to some of the classic symptoms of nutrient overenrichment, such as high phytoplankton biomass and low dissolved oxygen. The Bay's resistance to high nutrient loads results from its high turbidity, strong tidal mixing, and large filter-feeding clam populations, all of which limit the efficiency with which abundant nitrogen and phosphorous are converted into phytoplankton biomass. However, recent observations indicate that the Bay's resistance to high nutrient loads is weakening, and that conditions are trending toward increased productivity and potential impairment. To address growing concerns about the Bay's changing response to nutrient loads, regulators, dischargers, stakeholders, and regional scientists are working collaboratively to develop and implement the San Francisco Bay Nutrient Strategy. The Nutrient Strategy lays out an approach for building the scientific foundation to inform upcoming, and potentially costly, nutrient-related management decisions. This presentation will discuss recent activities related to the Nutrient Strategy: conceptual model development and identification of highest priority science questions and data gaps; estimates of external nutrient loads; and monitoring program, modeling program, and assessment framework development.

Keywords: Nutrient Science, Priorities, Bay

Session Title: Nutrients: Managing a Changing Bay

Speaker Biography: David Senn is a Senior Scientist at the San Francisco Estuary Institute (SFEI). He received his PhD in environmental engineering from MIT, where he studied the interactions between nitrogen pollution and iron and arsenic cycling in contaminated urban lakes. Subsequently, as a researcher at the Harvard School of Public Health, he conducted contaminant fate, transport, and exposure studies, including investigating mercury cycling, bioaccumulation, and human exposure in the Gulf of Mexico. Prior to joining SFEI in 2011, he worked at the Swiss Federal Institute of Aquatic Science and Technology (Eawag), studying the impacts of large dams in the Zambezi River Basin in southern Africa.

Counting Calories in the Bay: What is the Recommended Daily Allowance?

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San Francisco Bay is a nutrient-rich ecosystem that has not traditionally been considered at risk of impairment due to nutrients. Many of the wastewater treatment plants constructed in the early years of the Clean Water Act were not required to address the discharge of nitrogen or phosphorus. In fact, the 1975 Basin Plan for San Francisco Bay identified other factors in the Bay, lack of light penetration and high turbidity, as principally limiting algal growth in the Bay. However, the ecosystem is changing. Since 1999, suspended sediment concentrations have been decreasing and phytoplankton abundance, as measured by chlorophyll, has been increasing. A changing ecosystem, renewed national and regional interest in the development of nutrient criteria, the acknowledgement that there is significant loading of nutrients from treated wastewater to the Bay and the expense of nutrient removal, are creating a pressing interest and need to think proactively about nutrients in San Francisco Bay. The goal of the Water Board's effort is to develop regulatory strategies that adapt to the Bay's changing conditions in order to avoid the potentially significant effects of harmful algal blooms, hypoxia, shifts in phytoplankton assemblages and the resulting impacts to aquatic life. The Water Board is working collaboratively with wastewater dischargers, the Regional Monitoring Program and other interested parties to implement a Nutrient Management Strategy that takes a proactive approach to improve our understanding of the Bay Ecosystem. Important steps include development of an assessment framework to evaluate beneficial use impairment, continued surveillance of the Bay's response to nutrients and modeling to help us answer the question, "What is the recommended daily allowance of nutrients?"

Keywords: Nutrients, San Francisco Bay Nutrient Management Strategy, Wastewater, Nutrient Standards

Session Title: Nutrients: Managing a Changing Bay

Speaker Biography: Naomi Feger is the Chief of the San Francisco Bay Water Board's Planning Division. She is responsible for a number of Board programs, including water quality standards, TMDLs and policy development. She has a lead role in the Water Board's Nutrient Management Strategy, the Water Boards' Bay-Delta Team, and the San Francisco Bay Regional Monitoring Program. She previously worked at the Water Board overseeing CERCLA cleanups, specializing in human health and ecological risk assessment to support in-Bay and upland cleanups, and wetland restoration projects. Prior to the Water Board, she worked as a Senior Project Manager for the consulting firm SAIC.

Nutrient Management: A Statewide Perspective

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California State Water Resources Control Board (SWRCB) is developing nutrient water quality objectives for the State's surface waters, using an approach known as the Nutrient Numeric Endpoint (NNE) framework. The NNE establishes a suite of regulatory endpoints based on the ecological response of an aquatic waterbody to nutrient over-enrichment (eutrophication, e.g., dissolved oxygen, algal biomass, etc.). It uses models to link these response indicators to nutrients and other waterbody specific management controls. The first step in developing the NNE framework is to develop science plan to govern technical studies that will support policy decisions. The approach is similar whether the target is an estuary, lake, river, or for particular waterbodies such as San Francisco Bay. This talk will link elements of the San Francisco Bay nutrient management strategy to technical approaches being used to develop nutrient objectives and nutrient management strategies statewide, highlighting common themes, challenges, data gaps and scientific uncertainties, and opportunities to leverage efforts.

Keywords: Nutrients, NNE, SWRCB

Session Title: Nutrients: Managing a Changing Bay

Speaker Biography: Dr. Martha Sutula is head of SCCWRP's biogeochemistry department, where she oversees projects related to eutrophication and harmful algal blooms in streams, estuaries and nearshore waters, tracking sources and fate of contaminants including stormwater and atmospheric deposition, remote sensing, and water quality modeling. Her most recent work includes providing technical support to the California State Water Board to develop nutrient objectives for California waterbodies. Dr. Sutula received her undergraduate degree in Chemistry from Purdue University in 1987, her Master's in Public Health from Tulane University in 1994, and her Ph.D. in Coastal Ecology from Louisiana State University in 1999. She joined SCCWRP in March 2001.