



Lead Scientist's Report

Summary: Delta Lead Scientist Dr. John Callaway will discuss a recent article from *San Francisco Estuary and Watershed Science* on water budgets for the Delta watershed, revisit an article on water supply reliability from the 2016 *State of Bay-Delta Science*, discuss the recent review of Delta Mercury Control Studies and the Remote Imagery Consortium Workshop, cover upcoming topics, and provide the By the Numbers Report.

Water Budgets for the Delta Watershed: Putting Together the Many Disparate Pieces. Ariyama, J.; Boisramé, G.F.S.; and Brand, M.R. *San Francisco Estuary and Watershed Science*. June 2019.

Water budgets are quantitative records of the amount of water that moves in, out, and within a watershed. They factor in measurements such as changes in water storage, precipitation and evaporation rates, and water use. Water budgets also inform water management actions, including surface water allocation, groundwater use, drought preparedness, and more. Previous research on water budgets is complete for portions of the Delta watershed, but that research did not include a comprehensive, overall watershed and Delta water budget. Reliable water budgets are needed to manage a sustainable water supply, given California's variable climate. Water budgets relate directly to Chapter 3 of the Delta Plan and its goal of achieving a more reliable water supply for the state.

The authors of this study, all former Delta Science Program staff, developed water budgets from a range of sources for the Sacramento-San Joaquin Delta and the Sacramento and San Joaquin River watersheds. Using data from 1998 to 2009, the authors calculated water budgets for an average rainfall year, a wet year, and a critically dry year. The water budgets provide a baseline from which the impacts of stressors on the system can be evaluated.

The authors incorporated data on precipitation, evaporation, river flows, water imports and exports, and reservoir and groundwater storage, and also addressed data limitations and uncertainties for these various water budget components. There were relatively consistent measurements available for river flows, water exports, and precipitation, but gaps remain in the estimation of groundwater storage, and evaporation and precipitation in mountain regions. These water budgets are the first to include the entirety of the watershed, a comparison of wet and dry years for different regions, and suggestions for improvement of data collection and synthesis efforts to close knowledge gaps for watershed budget formation and management.

California's Agricultural and Urban Water Supply Reliability and the Sacramento-San Joaquin Delta. Lund, J. *The State of Bay-Delta Science and San Francisco Estuary and Watershed Science*. October 2016.

Given the critical role the Sacramento-San Joaquin Delta plays in California's water supply, it is essential to evaluate the challenges associated with reliance on Delta water. This article is an excellent refresher of the challenges in achieving the coequal goals. In this article, featured in the 2016 *State of Bay-Delta Science*, Dr. Jay Lund, a member of the Delta Independent Science Board, reviews issues relating to reliability of Delta water supplies and how the current complex infrastructure, operations, and regulations were developed to deal with the mismatch between the state's water supply and demand. Dr. Lund covers key topics, including climate and year-to-year variability that impact the watershed, and how science and modeling contribute to addressing water management.

Dr. Lund discusses the estimations of water delivery reliability, which uses historical data and predictive representations of water demands, regulations, and infrastructure for given areas to calculate water delivery reliability. Proposed improvements can be added to this calculation to determine how to achieve water reliability and availability, although no models are perfect. Options to improve reduced reliance on the Delta's increasingly taxed water supply come from a portfolio of approaches, including water conservation, reuse, desalination, storage expansion, and changes in Delta water diversion infrastructure.

The degree to which these approaches have been tried, and to what level of success, varies considerably, as does their feasibility. The portfolio approach to water management, however, increases flexibility by incorporating a mix of actions. This integrated form of resource management does not come without its challenges and requires collaboration across all components of water import and export.

Independent Review of the Delta Mercury Control Studies – Urban Stormwater and Wastewater

The Central Valley Regional Water Quality Control Board (Central Valley Regional Board) has developed a Delta Mercury Control Program (Control Program) to address harmful levels of mercury found in some fish eaten by people and wildlife in the Delta. The Control Program is consistent with the Delta Plan recommendation to implement regulatory efforts for mercury (WQ R8), which requires entities discharging mercury to execute control studies to inform and improve the implementation of mercury control plans. The Central Valley Regional Board requested that the Delta Science Program coordinate a series of reviews to assess the scientific validity of the studies included in the initial phases of the Control Program to ensure that best available science is used to inform the Control Program moving forward. The Delta Science Program will review two sets of studies for the Central Valley Regional Board. This first review assessed urban stormwater and wastewater mercury control studies. In 2020, the Delta Science Program will review a study of mercury dynamics in tidal wetlands and a mercury model for open water in the Delta and Yolo Bypass.

In their first review (completed in August 2020), the Review Panel found the urban stormwater and wastewater control studies ranged in scientific strengths, and they identified challenges associated with using the results of the studies to inform regional trends in mercury loads. The Review Panel noted that although methylmercury loads from these entities were small in the context of the overall methylmercury budget for the Delta, continued monitoring and reporting of methylmercury will be critical to inform future mercury mitigation efforts and provide insights into the impacts of climate, land-use, and population change on mercury loading in the Delta. Information from these reviews will be used by a subsequent Advisory Panel, to be convened by the Delta Science Program in late 2020, to provide recommendations to the Central Valley Regional Board on how to use science to inform the broader-scale implementation of the Control Program.

Remote Imagery Collaborative Workshop

The Delta Science Program convened its second half-day workshop for the Remote Imagery Collaborative (RIC) on Aug. 21, 2019 as a follow-up to an initial meeting in April 2019. Remote sensing is a highly valuable tool that can be used to monitor and assess many parameters across the broad scale of the landscape, from vegetation and elevation to water quality. It is widely used in the Delta, but data are often collected and analyzed on a case-by-case basis. Improved collaboration for remote sensing has been called for across many agencies, and the RIC is a new effort by Delta scientists and managers to work together toward more effective and efficient use of remote sensing products, tools, and technologies. Through more effective use of remote sensing approaches, the RIC seeks to fulfill multiple data and information needs associated with the Delta Plan. The workshop included more than 30 representatives from state and federal agencies, non-profit organizations, academia, and industry.

Workshop presentations and breakout discussions addressed existing and emerging remote sensing technologies, as well as the development of a unified needs assessment for projects that utilize remote sensing. Attendees at the workshop agreed that no single agency could complete all remote sensing monitoring needs on its own and that consistent funding for coordinated remote imagery monitoring, analysis, and synthesis is needed. The collaboration within the RIC continues to develop and embraces the vision of *One Delta, One Science*, and improved collaboration would assist with the development and tracking of Delta Plan performance measures.

On Your Radar

Request for Applications for the 2020 Delta Science Fellowship Program:

The call for applications for a new class of Delta Science Fellows will be released in late September. This ongoing initiative supports graduate students and post-doctoral researchers at their host university, to conduct research regarding the Bay-Delta on

high priority issues identified in the Science Action Agenda, including human dimensions of resource management, synthesis, habitat restoration, impacts of stressors on managed species, and modeling. More information about Delta Science Fellowships can be found at: <https://caseagrant.ucsd.edu/fellowships/types/delta-science-fellowship>.

State of the Estuary Conference:

This biennial conference brings together key players in the Bay-Delta science community to discuss ongoing and emerging topics of interest. Delta Stewardship Council staff are organizing several sessions and presentations on topics such as climate change, Bay-Delta connections, and the need for forward-looking science in the Bay-Delta. The Conference takes place in Oakland on October 21st and 22nd and more information is available at: <https://www.sfestuary.org/state-of-the-estuary-conference/>.

By the Numbers

Delta Science Program staff will provide a summary of current numbers related to Delta water and environmental management. The summary (Attachment 1) will inform the Council of recent counts, measurements, and monitoring figures driving water and environmental management issues.

List of Attachments

Attachment 1: By the Numbers Summary (provided at the Council Meeting)
Attachment 2: Water Budgets of the Delta Visual Abstract

Contact

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