



Lead Scientist's Report

Summary: Delta Lead Scientist Dr. John Callaway will provide a quick overview of three recent articles, one summarizing the history of *San Francisco Estuary and Watershed Science*, another from the *Journal of American Water Resources Association* on 'perfect droughts', and a third from the *Journal of Fish Biology* on lamprey distribution; He will also review the status of upcoming events, and the By the Numbers Report. Councilmembers are encouraged to contact Dr. Callaway with any questions.

Sixteen Years of San Francisco Estuary and Watershed Science: A Retrospective. Luoma, S.N., and L.D. Muscatine. *San Francisco Estuary and Watershed Science*. December 2019.

The journal *San Francisco Estuary and Watershed Science* (*SFEWS*) recently celebrated 16 years of publication. The journal was conceived as a way to communicate the expanding breadth of scientific knowledge coming from the CALFED Bay-Delta Program in the early 2000s. *SFEWS* was intentionally developed as a multi-disciplinary, peer-reviewed, objective source of information for anyone interested in issues across the Estuary and its watershed, including the dual audience of scientists and managers. Over the years *SFEWS* has continued to provide scientific information relevant to regional policy needs and has grown in its reach and ranking among scientific journals.

Funding for *SFEWS* is provided by the Delta Stewardship Council, with additional support from the University of California Digital Library and the John Muir Institute of the Environment at the University of California, Davis. In addition to regular journal publications, *SFEWS* publishes articles for the *State of Bay-Delta Science*, one of the Delta Science Program's key synthesis efforts. Access to *SFEWS* is "open-access" to both readers and authors, meaning there is no charge to publish or read articles. This ensures that the journal is available to agency staff and others who typically have not had access to subscription-based journals, although State agency staff now have broader access to subscription-based journals.

A Long View of Southern California Water Supply: Perfect Droughts Revisited. Woodhouse, C.A., D.M. Meko, and E.R. Bigio. *Journal of the American Water Resources Association*. January 2020.

Tree rings, the bands of growth seen within a tree trunk, can provide information about climate and water conditions over many centuries. This type of research, part of the field of paleoclimatology, also can inform our understanding of potential future climate conditions, including periods of drought. Droughts put strain on water availability, and 'perfect droughts,' where drought occur simultaneously across multiple regions, can be extremely challenging for water management.

In this study, funded by the Department of Water Resources, researchers evaluated recent droughts affecting Southern California using both monitoring records and paleoclimate approaches to evaluate water trends going back centuries. They assessed perfect droughts across three regions that supply water for Southern California: the Sacramento River watershed, the Colorado River watershed, and Southern California itself. The recent multi-year perfect drought from 2012-2015 was rare but not unique. The past 100-years have had more widely spaced distribution of perfect droughts, with fewer clusters of droughts through time. However, the recent past is not necessarily the best predictor of the future, and longer-term data record may provide insights into potential variability in future climate conditions.

The researchers used tree ring data to evaluate periods of perfect drought over the past 900 years. They found that over this period, perfect droughts were: (1) relatively common; (2) unevenly distributed through time; (3) variable in length and character; (4) sometimes clustered events; (5) difficult to predict; (6) observed under a variety of oceanic/atmospheric circulation patterns; and (7) associated with a high pressure system off the Pacific Northwest which can divert precipitation from water source areas. Future warming may lead to more frequent perfect droughts, although based on past records they still remain relatively unpredictable and variable events.

Water management, including consideration of droughts, is discussed throughout the Delta Plan and relates directly to the coequal goal of providing a reliable water supply for California. The impacts of drought and climate change are also a priority for research in the Science Action Agenda (Action Area 1, 3B, 4B, 4C) and the Delta Science Plan (Actions 3.3, 3.9, 4.1). Coordination of science (in terms of modeling, predictive capacity, monitoring, and research) and decision-making will be critical in the future to answer questions related to droughts, including perfect droughts.

Lamprey (*Entosphenus* sp. and *Lampertra* sp.) Estuarine Occupancy Is Regionally Variable and Constrained by Temperature. Goertler, P.A.L., A.W. Shakya, A.M. Seesholtz, B.M. Schreier, S.Z. Matica, and K.S. Holley. *Journal of Fish Biology*. 2020.

Lamprey are migratory native fish, including three species that are an important component of aquatic food webs in the Bay-Delta. However, their distribution within the Bay-Delta has been poorly studied. Available habitat for lamprey has been reduced in areas in the watershed due to habitat degradation and dams, which restrict their migration. These impacts put more importance on the lower river and Bay-Delta for lamprey habitat.

This study compiled data from multiple monitoring programs between 2006 and 2016 to better understand the extent and physiological constraints to lamprey habitat use within the Bay-Delta. Juvenile lamprey habitat use was found to be regionally variable, and they were most common in the lower Sacramento River and at the confluence of the Sacramento and San Joaquin rivers. Lamprey also were more likely to be found in areas with lower water temperatures. This information may be important for future restoration and management efforts as water temperatures are predicted to rise with climate change.

The Delta Plan acknowledges the importance of climate change for the management of California's water and ecosystems. Improved understanding of climate change effects on species distribution supports effective decision-making through science-based adaptive management, as outlined in the Delta Science Plan. Studies such as this also highlight the value of synthesis of existing datasets to improve management efforts.

Estuarine Connectivity Symposium.

Ecological connectivity describes the movement of organisms, resources, and other materials across landscapes. In estuarine systems, understanding and managing connectivity is key to strengthening ecosystem resilience and adaptation potential in the face of a rapidly changing climate and sea level rise. On February 18, 2020, the Delta Science Program organized a symposium to stimulate further thinking in the science and policy communities about a range of connectivity issues for the San Francisco Bay-Delta Estuary.

In the morning speakers provided overviews of aquatic and terrestrial connectivity, followed by more in-depth talks on important connectivity concepts such as effects of connectivity on genetics, demographics, and contaminant exposure. Governance for restoring connectivity in estuaries was also discussed. The afternoon speakers took a holistic look at changes in connectivity in the Delta over time, delving into case studies (e.g., migrating birds, nutria, examples of increasing connectivity within the Estuary) followed by panel discussions exploring different aspects of connectivity in the Estuary.

The symposium highlighted that there are many aspects of connectivity to consider in estuaries. The San Francisco Bay-Delta Estuary is fragmented and disconnected in some ways, but over-connected in other ways. Management should focus on restoring connectivity functions that are foundational to healthy ecosystems, including the focus on the land-water interface that is an integral part of the amendment to Chapter 4 of the Delta Plan.

Integrated Modeling Steering Committee Workshop.

The Delta Integrated Modeling Steering Committee held a workshop on February 13, 2020, with approximately 40 attendees from State and Federal agencies, academia, and private consulting firms. The goals for the workshop were to review the recently finalized technical memos and a synthesis report produced by Tetra Tech for the Integrated Modeling Steering Committee and to discuss and prioritize recommendations and near-term action items identified in these reports. Workshop participants agreed that the development of an enhanced integrated modeling effort is warranted and will provide improved information for complex management decisions in the Delta. Some examples of suggested near-term action items include, creating training opportunities for staff that use modeling results, improving web-based resources and infrastructure to improve efficiency and knowledge sharing, and identifying methods to incorporate a unified set of modeling best practices into the Delta modeling culture. Next steps are to combine the input collected during the workshop with recommendations from the synthesis report into a final strategy document that identifies priority actions to advance integrated modeling efforts in the Delta.

On your radar

These are some events and initiatives that have recently occurred or will be occurring to keep in mind. The Delta Science Program is monitoring upcoming events to assess if prudent measures need to be taken to reduce community transmission of COVID-19. Any change to the schedule for these events will be publicized widely.

Science Needs Assessment Workshop:

In early 2019, the Delta Independent Science Board called on the Delta Plan Interagency Implementation Committee (DPIIC) to initiate and lead a bolder, forward-looking science program that provides policymakers and managers with scientific information to address long-term, emerging issues for the Delta. The workshop for this effort, scheduled for April 27-28, 2020, has been postponed. More information will be provided when the event is rescheduled. The released briefing paper is available at: <http://deltacouncil.ca.gov/pdf/dpiic/meeting-materials/2020-03-11-science-needs-assessment-workshop-briefing-paper.pdf>.

California Water and Environmental Modeling Forum Annual Meeting:

The California Water and Environmental Modeling Forum has postponed its 26th Annual Meeting from April 13 to 15, 2020 at the Lake Natoma Inn in Folsom. The meeting brings together various agency engineers and scientists to develop collaborative efforts that support modeling to inform California's environmental and water challenges. More information will be provided when the event is rescheduled.

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: Visual abstract of temperature and region drive lamprey distribution in the Bay-Delta.

Contact

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