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INFORMATION ITEM

Lead Scientist's Report

Summary: This report covers eight items:

Collaborative Science Activities: (1) Delta Science Fellows 2013 research results (2) Delta and Longfin Smelt symposium at UC Davis (3) California WaterFix Aquatic Science Peer Review (4) California Water and Environmental Modeling Forum (CWEMF) and Interagency Ecological Program (IEP) annual meetings.

Science Communication: (5) Journal article on influence of air temperature on streamflow (6) Research article from San Francisco Estuary and Watershed Science (SFEWS) journal on optimizing reservoir operation (7) Two posters from the 2015 State of the Estuary Conference, and (8) the "By the Numbers" summary.

Collaborative Science Activities

Delta Science Fellows 2013 Research Results

Research results from the 2013 Delta Science Fellows cohort are emerging. Topics addressed and the management implications of completed research are summarized in Attachment 1. The goal of the Delta Science Fellows Program is to bring together junior scientists with Delta agency scientists and senior research mentors to work collaboratively on data analysis and research projects relevant to Delta policy and management. Research by the 2013 Delta Science Fellows addresses management actions pertaining to: 1) hatcheries, 2) river temperature manamgent, and 3) detecting and tracking sources of pollution, and providing data to help assess the impacts of wetland restoration and climate change. For more on this program, see Agenda Item 7c, which requests a continuation of funding for the 2017 Delta Science Fellows.

Delta and Longfin Smelt Symposium at U.C. Davis

A one-day symposium on March 29, sponsored by the Delta Science Program and U.C. Davis Center for Marine Science Institute, titled, "Delta and Longfin Smelt Symposium: Is Extinction Inevitable?" featured a series of talks by leading researchers updating the species' status, links to population declines, and the exploration of how recovery planning, restoration efforts and decision-making efforts intersect to devise a way to sustainably manage Delta and longfin smelt. A final panel with representatives from state and federal resource agencies, non-government organizations, and local water districts, discussed potential paths forward for smelt recovery. Panelists expressed tentative optimism for the future viability of Delta and longfin smelt over the next decade stressing the need for timely management actions based on best available science that utilize a multifaceted adaptive management approach which address: habitat restoration, food web dynamics, introduced species, water quality and flow. The symposium talks and panel discussions may be viewed at: http://ats.ucdavis.edu/ats-video/?kpid=0_5b5wmf2b.

California WaterFix Aquatic Science Peer Review

At the request of the National Oceanic and Atmospheric Administration, select staff from the Council's Delta Science Program convened an independent scientific peer review for the joint Biological Opinion and 208 1(b) Incidental Take Permit analyses of the California WaterFix aquatic science on April 4-5. Peer review panelists included three independent consultants with

expertise in civil engineering, environmental statistics, natural resource management and three professors from the University of Washington, University of Oregon, and Oregon State University. Review materials, background information, and presentations may be found at: http://www.westcoast.fisheries.noaa.gov/central_valley/WaterFix/index.html.

California Water and Environmental Modeling Forum (CWEMF) and Interagency Ecological Program (IEP) Annual Meetings

The CWEMF annual meeting and IEP Annual Workshop met on April 11-13 and April 20-22, respectively. The CWEMF annual meeting focused on modeling environmental extremes brought on by droughts and floods. Dr. Dahm provided a plenary lecture on the use of models in studying stream and river hydrology and biogeochemistry and the support of modeling efforts by the Delta Science Program and the Delta Stewardship Council. The three-day workshop focused on 1) modeling advancements in water rights and flood management, 2) groundwater, flood modeling, environmental water management, and integrated hydrodynamic modeling, and 3) advances in climate change research, progress on the California Water Plan Update, and conjunctive use. The IEP Annual Workshop provided a three-day forum for sharing research results and technical analyses that advance the understanding of scientific topics important to the Delta science community. Oral sesssions and posters focused on scientific advances in: sturgeon, smelt, and salmonid biology, aquatic food webs and nutrients, Upper San Francisco tidal wetland restortation, fish monitoring, emergency drought barrier monitoring, temperature impacts on fish metabolism and physiology, and IEP assessment of monitoring and modeling impacts from drought on the Bay-Delta.

Science Communication

Provided below is a summary of recent research showing how air temperatures can influence stream flow. With increasing temperatures expected due to climate change, this information is critical for water resource management.

Increasing influence of air temperature on upper Colorado River streamflow
Connie A. Woodhouse, Gregory T. Pederson, Kiyomi Morino, Stephanie A. McAfee, Gregory J. McCabe. Geophysical Research Letters, 2016

The amount of snow and rain that falls to the ground is the dominant influence on the volume of water that ultimately flows into streams and rivers. Models have predicted that air temperatures also play a role in overall stream flow volume, but at marginal levels of significance compared to precipitation. However, the extent of air temperature influence on stream flow volumes is currently not well understood. Understanding how temperature affects water flows is critical for resource management into the future. Current droughts and a warming climate add to our need for further research.

Using historical records dating back to 1906, these researchers recently determined how air temperature influences stream flow in the upper Colorado River basin. As expected, the amount of precipitation is the main driving force determining the amount of stream flow. Yet, during drought years, air temperature played a bigger role in stream flow than expected. For example, the drought of the 1950s was the most severe (least amount of precipitation), while the 2000s drought was the least severe. However, average flows were similar during these two droughts. This can be explained by considerably cooler air temperatures during the 1950s drought. The cooler temperatures in the 1950s helped offset the greater precipitation deficits (and vice versa in the 2000s). Warmer air temperatures significantly reduce stream flow in dry years.

This study took place in the Colorado Rockies, but has water reliability implications throughout the world including for the Bay-Delta. The results are particularly informative for snowmelt-dominated catchments worldwide. The research strongly suggests that climate warming is an increasingly important factor in determining the volume of water supply in such catchments during periods of drought. Air temperatures are not currently routinely used in forecasts of water availability. This means that water managers run the risk of over predicting amounts of available water during warm and dry years unless this interaction with temperature is included.

March 2016 Issue of the SFEWS Journal

The March issue of the Council-supported SFEWS Journal is currently available online. This open access journal, funded by the Council, is a key venue for publishing the latest research addressing Delta scientific questions. This edition includes one essay and five research papers. One of these articles is highlighted here.

Reservoir Operating Rule Optimization for California's Sacramento Valley
Nelson, Timothy; Hui, Rui; Lund, Jay; Medellín–Azuara, Josué

Nelson et al. (2016) utilize CALVIN, a hydro-economic optimization model to determine economically-optimized release and storage reservoir operation rules for major Sacramento River Valley reservoirs (e.g. Shasta, Trinity, and Oroville). Some of the economic optimization rules include: preferred release of water from Shasta when the previous year was wet, but preferred release of water from Trinity if the previous year was dry. The authors discuss limitations of the CALVIN model in both studies noting that the model runs on a monthly time-step and that reservoir operators commonly need daily or hourly projections. In addition environmental regulations are only coarsely represented in the modeling framework. Further modeling of the environmental impact of changing release and storage reservoir operation rules is needed for more effective reservoir operations.

Poster Summaries from the 2015 State of the Estuary Conference
The biennial State of the Estuary Conference is a forum focusing on the management and ecological health of the San Francisco Bay-Delta Estuary. Results from the conference are relevant to the Delta Science Program's mission to provide the best possible, unbiased, science-based information for water and environmental decision-making in the Bay-Delta system. The following posters from the last conference in September 2015 are a sampling of the 161 posters presented at the conference and were selected because they are relevant to topics before the Council this month and to recent symposia held by Delta Science Program staff.

Fishes of the Nurse-Denverton Complex: evaluating fish in a restoring tidal marsh and a managed wetland *Brian Williamson and Melissa Riley*

Over the next 30 years, the Suisan Marsh Plan calls for the restoration of 5000-7000 acres of the Marsh's managed wetlands. However, the importance of managed wetlands for fish communities or the effectiveness of restoration at these sites is not known. Researchers from U.C. Davis and California Department of Fish and Wildlife compared fish abundance, diversity, and the percentage of native fishes at a restored site (Blacklock Marsh; restored 2006), a managed tidal marsh site (Luco Pond), and adjacent sites. They found that all three metrics were lower at Blacklock Marsh, where the invasive Mississippi silverside dominated the catch, than at Luco Pond, where threespine stickleback contributed to the high total abundance. A greater diversity of

fishes was also found at sites adjacent to Blacklock Marsh than at the restored site, suggesting that few fish were entering the restored site. Sustained long-term surveys are needed to understand the effects of wetland restoration on fish communities and the movement of fish at wetland restoration sites.

Greenhouse gas emissions and carbon sequestration potential in restored wetlands in the Sacramento-San Joaquin Delta, California *Sara Knox, Cove Surtevant, Patty Oikawa, Jaclyn Hatala, Dennis Baldocchi*

Wetland restoration results in the sequestration of carbon dioxide (CO_2) from the atmosphere and the reversal of soil subsidence, but could also increase the overall greenhouse gas (GHG) budget by acting as a source of methane. Workers from UC Berkeley, the National Ecological Observation Network (NEON), and Dartmouth University determined the effects of wetland restoration on carbon dynamics and how these dynamics changed during wetland development. They monitored two restored freshwater marshes at different stages of restoration (restored 1997 and 2010) in the Sacramento-San Joaquin Delta over multiple years. They found that the older restoration site exhibited greater CO_2 uptake, slightly less temporal variability in CO_2 fluxes, and emitted less methane than the younger restoration site. Calculations for the GHG budget indicated that the younger restored wetland was a GHG source, while the older wetland was a GHG sink for two out of the three years monitored. Thus, wetland restoration has the potential to reduce GHG emissions in the Delta, but managers might expect greater initial variability in CO_2 uptake and higher production of methane immediately following restoration.

By the Numbers
Delta Science Program staff will give a summary of current numbers related to Delta water and environmental management. The summary (Attachment 2) will inform the Council of recent counts, measurements, and monitoring figures driving water and environmental management issues.

Fiscal Information

Not applicable.

List of Attachments

Attachment 1: Summary Table of 2013 Delta Science Fellows Research Results
Attachment 2: By the Numbers Summary *(report to be provided at the Council Meeting)*

Contact

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