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Lead Scientist's Report

Summary: This report covers 7 items:

Collaborative Science Activities: (1) Brown Bag Seminar on alternative monitoring approaches for Delta wetland restoration projects during accelerated climate change (2) California Water Policy Seminar Series on Drought at UC Davis

Science Communication: (3) Research article on riverine nutrient trends in the Delta watershed from *San Francisco Estuary and Watershed Science* (SFEWS) journal (4) Journal article on a global analysis of harmful algal blooms (5) 2015 NOAA State of the Climate Report (6) Two posters from the 2015 State of the Estuary Conference, and (7) "By the Numbers" summary.

Collaborative Science Activities

Brown Bag Seminar - Alternative Monitoring Approaches for Large Bay-Delta Estuarine Wetland Restoration Projects: Adapting to Uncertainty and Novelty during Accelerated Climate Change

This seminar, one of the Council's regularly scheduled Delta Science lunchtime seminars, was held Feb. 17, 2016. In the 21st century, many tidal wetland restoration projects have become larger and are increasingly independent of compensatory mitigation requirements. They now face major new uncertainties regarding the pace, patterns, and trajectories of marsh succession. Invasive species, declines in sediment supply, and predictions of abrupt, accelerated climate change and sea level rise now require revisions of previously less complex assumptions about estuarine wetland restoration. Dr. Peter Baye, San Francisco State University, discussed how more comprehensive conceptual models of wetland succession enable researchers to anticipate changes in restored marshes while guiding more efficient, focused, and meaningful monitoring and restoration design thereby furthering the achievement of the State's coequal goal of a healthier Delta ecosystem.

California Water Policy Seminar Series on Drought at UC Davis

The Center for Watershed Sciences is hosting a weekly public seminar series from January 4 to March 14 on California water policy in response to drought. Seminars will cover climate and drought in California, drought related environmental impacts, local and state responses to drought, law and policy related to drought response, and state and federal legislative topics. The series will conclude with a panel on drought scholarship and engagement. The seminar series schedule and video of past lectures are available online at: http://johnmuir.ucdavis.edu/california-water-policy-seminar-series-drought.

Science Communication

December 2015 Issue of the SFEWS Journal

The December issue of the 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 four research papers. A research article on Delta watershed riverine nutrient trends is summarized here.

Riverine Nutrient Trends in the Sacramento and San Joaquin Basins, California: A Comparison to State and Regional Water Quality Policies.
Schlegel, Brandon; Domagalski, Joseph L.

In the late 1980's non-point source contaminant control strategies were initiated in California under the federal Clean Water Act. Most of the control strategies for California's Central Valley targeted pesticides but not nutrients that can adversely affect aquatic ecosystems. In this study workers from California State University Sacramento and the USGS evaluate the effect of non-point source agricultural control strategies implemented in the Central Valley on nutrients (e.g., phosphorus, nitrogen, nitrate, and ammonia) before and between 1990 and 2013. Overall results show declines in nutrient concentrations in the basins and suggest that non-point source contaminant control strategies may limit runoff of non-targeted constituents such as nutrients.

Journal article – "An Integrated, Holistic Approach to Detecting and Characterizing Cyanobacteria Blooms Could Reduce Human Health Risks and Better Direct Field Resources" This is a brief summary of an article by Blake Schaeffer et al that appeared in the November 15, 2015 edition of the American Geophysical Union's *Eos* journal.

When conditions are right, certain microbes within water can multiply rapidly. These microbial blooms are often unsightly, can affect the taste and odor of drinking water, and may produce toxins harmful to humans and other animals. Cyanobacteria (commonly known as blue-green algae despite the fact that they are bacteria and not algae) are an evolutionarily ancient, genetically diverse group of microbes found in water all over the world, including the California Delta. Blooms of cyanobacteria can release toxins at levels that pose substantial risks to human and animal health via ingestion, skin contact, or inhalation. Previous efforts to reduce human exposure to these toxins have not always been successful due to the cost and difficulty of quickly disseminating complex scientific observations to decision makers. Developing accessible, cost-efficient early-warning indicators for cyanobacterial blooms will help environmental managers to more effectively gage water safety and provide timely warnings.

The Cyanobacteria Assessment Network (CyAN) is a collaborative effort of the National Aeronautics and Space Administration (NASA), the National Oceanic and Atmospheric Administration (NOAA), the U.S. Geological Survey (USGS), and the Environmental Protection Agency (EPA). CyAN detects early signs of blooms using novel sensors and mathematical tools linked to satellite data. An Android mobile application allows local water managers to have timely access to useful information, preventing public exposure to harmful blooms in recreational waters or informing the need for more extensive treatment of drinking water. CyAN will also further our understanding of how human activities and changes to the landscape affect bloom events and refine our knowledge of human health effects associated with cyanobacteria. CyAN is one of many approaches being taken to better understand and respond to algal blooms worldwide. Other studies are investigating how rising atmospheric CO2 levels and warmer temperatures can cause an intensification of cyanobacterial blooms. Pinpointing the emergence of toxic cyanobacterial blooms (like the cyanobacteria Microcystis in the Delta) early-on better protects human health and guides management actions.

2015 NOAA State of the Climate Report
The National Ocean and Atmospheric Administration *State of the Climate* reports are a collection of monthly and annual reports summarising climate-related occurrences on a global and national scale. Globally, 2015 was the warmest year on record surpassing 2014 global temperatures. Globally temperatures in 2014 are now the second warmest year on record.

Drought in California was exaccerbated by a second year of record high spring, summer, and December temperatures following 2014, California's warmest year on record. Snowpack levels in the Sierra Nevada for the fourth consecutive year were below normal in 2015 with record low snowpack levels occurring for several locations in the Northern Sierra. *State of the Climate* reports are available at: http://www.ncdc.noaa.gov/sotc/.

Poster summaries from California Salmon and Climate Variability Symposium
This one-day symposium at UC Davis held on Sept. 10, 2015 and partially funded by the Delta Science Program explored recent scientific progress toward understanding how variable and changing ocean and hydrologic conditions affect Central Valley salmon and their management. Topics included the feedbacks between climate and flows on salmon populations, understanding the effects of biodiversity on population stability, and how hatcheries and fisheries affect salmon. The following posters are a sampling of the posters presented at the symposium and were selected because they are relevant to topics before the Council this month.

Phenotype variability of Chinook Salmon on the Feather River spawning grounds: Using otolith strontium isotope ratios to determine run-timing and natal origins
Jim Hobbs, Malte Willmes, Ryon Kurth, and Jason Kindopp

Chinook Salmon hatchery practices in California may adversely affect Chinoook Salmon population resiliency by decreasing life-history diversity in fishery stocks. Quantitative estimates of the proportion of wild- and hatchery-raised salmon returning to Central Valley watersheds are needed to inform hatchery practices and conservation of salmon populations. Researchers from UC Davis utilize geochemical measurements from otoliths (fish ear bones) to determine the origin of returning Chinook Salmon just below the Feather River Hatchery on the Feather River from 2002 to 2010. Results indicate that the majority of returning adults were of hatchery origin and that the hatchery-raised fish typically return in October while wild salmon typically returned in November. With the majority of returning salmon coming from the hatchery, management practices may act to decrease life-history diversity in fishery stocks.

When Salmon go Salty…
Anna Sturrock, Rachel Johnson, Peter Weber, Tim Heyne, JD Wikert, Corey Phillis, George Whitman, and Stephanie Carlson

The number of Fall-run Chinook Salmon returning to the San Joaquin River has varied from a few thousand returning adults to over eighty thousand returning adults since 1952. The number of returning adults is highly correlated to the average January to June flows 2.5 years prior in the San Joaquin River measured just below the confluence of the Stanislaus River. Workers from UC Davis, with partial funding from the Delta Science Program, utilize the geochemistry of Chinook Salmon ear bones (otoliths) to investigate where (i.e. in the stream of origin, in the Delta, or after the freshwater exit) salmon mortality is occuring in dry years. Results show that independent of the number of spawning salmon the number of outmigrating juvenilles is depressed in dry years (i.e. in dry years no more than 500,000 outmigrating juvenilles were observed compared to > 2,000,000 outmigrating juvenilles in wet years). Possible mechanisms include: reduced habitat quantity/quality, egg dessication, increased predation, and/or density dependent mortality. A selective loss of larger juveniles, possibly driven by warmer, less hospitable Delta conditions in wet and dry years, was also observed. A greater variation in the size of outmigrating juvenilles was also observed in wet years that may increase population resiliency via life-history diversification.

By the Numbers
Delta Science Program staff will give 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 *(to be provided at the Council meeting)*

Contact

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