Lead Scientist's Report

Summary: Lead Scientist Dr. John Callaway will discuss two recent journal publications review the recent Water Data Science Symposium and Social Science Task Force Workshop, summarize the Brown Bag Seminar about the estuary's place along the continuum from the mountains to the ocean, and provide the By the Numbers Report.

Ten essential Bay-Delta articles. Sommer, T.; Conrad, J.L.; and Culberson, S. San Francisco Estuary and Watershed Science. June 2019. Plant detritus is selectively consumed by estuarine copepods and can augment their survival. Harfmann, J.; Kurobe, T.; Bergamaschi, B.; Teh S.; and Hernes, P. Scientific Reports (Nature). June 2019.

Delta Science Program Deputy Executive Officer Louise Conrad and Interagency Ecological Program Lead Scientist Steve Culberson worked with Department of Water Resources Lead Scientist Ted Sommer to compile a list of essential scientific articles relating to current management issues in the Delta. The essay highlights seminal work in the estuary in addition to recent articles that have shed light on critical science and management issues. The summaries of the articles are useful for both scientists and managers who are new to the Delta, and for Delta veterans who want a refresher on key science themes. These milestone articles cover topics including species decline, invasive species, climate change, flows, and floodplains. In addition to providing accessible summaries of these articles, the goal of this essay was to recognize the role of science in shaping today's policies and highlight the value of scientific collaboration.

Plant detritus is selectively consumed by estuarine copepods and can augment their survival. Harfmann, J.; Kurobe, T.; Bergamaschi, B.; Teh S.; and Hernes, P. *Scientific Reports (Nature).* June 2019.

The lead researcher for this study, Jennifer Harfmann, received funds for the project through the Delta Science Fellowship, and the group recently received funding through Proposition 1 to continue this line of scientific investigation.

Phytoplankton are microscopic algae that are a key component of the food web in estuarine systems. Nutritionally rich, phytoplankton provide food for zooplankton, which in turn feed fish and larger organisms. Phytoplankton productivity in the Bay-Delta is low compared to other estuaries and may limit food-web support for fish and other organisms. Detritus, or decaying plant matter, from tidal wetlands and floodplains, can provide additional productivity at the base of the food web. Little research, however, has evaluated the use of tidal wetland plants in Bay-Delta food webs, likely because of the limited wetland habitat that remains in the Bay-Delta. The question of the potential for food-web support by wetland plant detritus is of growing interest given plans for major wetland restoration within the estuary. Research on phytoplankton, zooplankton, and food-web dynamics relates directly to issues for the current amendment to Chapter 4 of the Delta Plan.

In this study, researchers examined the diet of a common copepod, a type of zooplankton, in the San Francisco Estuary. Scientists found that even when phytoplankton was abundant, and detritus from wetland plants were scarce, copepods consumed detritus. They also found that a mixed diet with a 1:3 ratio of phytoplankton to plant detritus increased copepod survival compared to a diet solely composed of phytoplankton. These results highlight that plant detritus from tidal wetlands can be an important part of a resilient food web. The new tools developed for analyzing copepod consumption of detritus using genetic methods may also have future uses for other food-web studies.

2019 California Water Boards Water Data Science Symposium

The Fourth Annual Water Data Science Symposium was held July 1-2, 2019 at the California Environmental Protection Agency. The symposium was hosted by the Surface Water Ambient Monitoring Program, the California Water Quality Monitoring Council, the California Water Boards Data Center, and the San Francisco Estuary Institute. The annual symposium highlights the value of water quality monitoring data to inform California water management decisions. This year's theme focused on "innovating through integrating and expanding the California water data community." The symposium featured sessions on open data, data visualization, harmful algal blooms, microplastics, remote sensing technologies, among others.

Highlights from the symposium included running a "datathon," where scientists worked together with data wranglers to gather data and organize it into a useful schema for managers and decision-makers. There was also a Community Water Science Workshop that covered best practices in water data. The Delta Stewardship Council was represented by members of the Planning Division, who discussed the importance of Delta Plan performance measures for California water management.

Social Science Task Force Workshop: Human Dimensions Research in Delta Environments

In collaboration with the Delta Science Program and the Coastal and Marine Sciences Institute at the University of California, Davis, the Delta Social Science Task Force hosted a workshop focusing on studies that address the human dimensions of research in the Delta, including the social and economic processes that underlie human values. The Task Force was initiated by the Delta Science Program, with the charge of developing a strategic plan to strengthen and integrate social sciences into the science, management, and policy landscape of the Delta.

The purpose of this workshop was to bring together social scientists from across the country to highlight how they study and address management challenges that are similar to those faced in the Delta. The workshop included sessions on invasive species management, flood risk and management, water and ecosystems, and social science integration. Discussions ranged from the challenges associated with the process of learning in large governance systems and the application of economic approaches to management issues, to evaluating responses to sea-level rise and determining assets

that communities value and want to protect. The workshop showcased a diversity of social science fields (e.g., economics, anthropology, public policy and governance, social psychology, and landscape design) that are available to address the range of complex management questions in the Delta. Some key takeaways of the day were:

- Many environmental management challenges are social questions;
- Integration of natural and social science perspectives is key, but social scientists also need to work across social science disciplines; and
- We need to build the capacity for social scientists within the Delta science enterprise.

Following the workshop, the Task Force will begin drafting its strategy report for strengthening and integrating social sciences into the Delta science enterprise. The draft is anticipated by mid-December, with time for public review. A video recording of the workshop is now available on the Coastal and Marine Sciences Institute webpage:

https://marinescience.ucdavis.edu/engagement/past-events/human_dimensions_research

Brown Bag Seminar

***The Place of Estuaries along the Continuum from Mountains to Oceans* – Jim Cloern, Senior Research Scientist Emeritus; USGS.**

In 1992, a coral reef off the coast of Israel was completely transformed when almost all of the coral died off as algae took over. The cause of this was a relatively sudden change in water temperature, which was in turn caused by the eruption of Mt. Pinatubo 6,000 miles away. The eruption ejected particles into the air that prevented light from penetrating waters off the coast of Israel. Dr. Jim Cloern began his brown bag seminar with this story to highlight his main point: ecosystems can be transformed by events that happen far away.

Dr. Cloern provided case studies of how the Bay-Delta has been affected by global, regional, and local processes. Only after gaining an understanding of these multi-scale dynamics can we begin to comprehend and manage the variability of Bay-Delta water temperatures, water quality, and species compositions. At the global scale, the Bay-Delta system has incurred lasting consequences due to events such as atmospheric rivers, trans-oceanic shipping, and changing oceanic temperatures and climate patterns. Processes occurring at the regional scale include damming rivers, historical hydraulic mining, agricultural runoff, and toxins produced by algae. Local-scale activities that effect Bay-Delta conditions include sewage disposal, water diversions, and landscape transformations.

The examples highlighted by Dr. Cloern underscore that when we think of the Bay-Delta system and how it changes, we need to broaden our thinking beyond just local-scale issues. These examples also reinforce the high degree of connectivity in the system and the resulting complexity. Dr. Cloern emphasized that his message is not that the system

is too complex to do anything about the challenges we face. On the contrary, we understand enough, but we must consider a “macroscopic” view when we consider how we do science, and the policies and regulations we put in place.

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 (report to be provided at the Council Meeting)

Attachment 2: Human Dimensions Research in Delta Environments Workshop

Attachment 3: Estuarine Copepods Visual Abstract

Contact

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