Lead Scientist's Report

Summary: Delta Lead Scientist Dr. John Callaway will discuss an article from *Ecosphere* on salmon life-cycle modeling, and from *San Francisco Estuary and Watershed Science* on the effects of the 2015 drought barrier, summarize the recent invasive species symposium, review staff science communication training, cover upcoming events, and provide the By the Numbers Report.

Modeling composite effects of marine and freshwater processes on migratory species. Friedman, W.R.; Martin, B.T.; Wells, B.K.; Warzybok, P.; Michel, C.J.; Danner, E.M.; and Lindley, S.T. *Ecosphere*. July 2019.

Anadromous fish (i.e., fish that are born and spawn in freshwater but live most of their lives in saltwater) have complicated life cycles with many potential points of influence on their overall survival. Human impacts, climate change, and other factors contribute to increased variability in the numbers of fish that return to spawn. These factors make it critical for scientists and managers to understand at what stages these species are affected, positively or negatively, and where the population can be managed effectively.

This study focused on evaluating different life stages of Central Valley fall-run Chinook salmon (*Oncorhynchus tshawytscha*). Fall-run Chinook are listed as a species of concern under the Endangered Species Act, while other Central Valley salmon runs are considered threatened or endangered. Researchers used data from 1988 to 2016 to develop a model simulating the salmon life cycle and to identify critical processes that contribute to variability in the population over time. They evaluated the range of processes that influence the population, only some of which are easily manageable.

The most influential processes affecting population dynamics were temperature during egg incubation, freshwater flow during juvenile migration, and predation when juvenile fish arrive in the marine environment. The first two factors offer management opportunities, while marine predation is not easily controlled. The model highlights the need for incorporation of impacts from multiple environments, life stages, and interactions to identify management solutions. The model can also be used to evaluate the effects of different management scenarios on salmon populations.

An improved understanding of fish life histories is relevant to the Delta as multiple anadromous species pass through the Delta each year. The restoration of migratory corridors used by these fish was identified as an issue for future evaluation and coordination in the Delta Plan (Chapter 4). The Delta Plan also considers water quality impacts to anadromous fish (Chapter 6). A more clear understanding of factors affecting fish populations will improve management decisions for these important fish.

Effects of drought and the emergency drought barrier on the ecosystem of the California Delta. Kimmerer, W.; Wilkerson, F.; Downing, B.; Dugdale, R.; Gross, E.S.; Kayfetz, K.; Khanna, S.; Parker, A.E.; and Thompson, J. *San Francisco Estuary and Watershed Science*. September 2019.

Reduced freshwater flows during droughts allow salt water to move further into the Delta and saltwater intrusion was a concern during California's most recent drought. To reduce water quality impacts in 2015, the California Department of Water Resources installed a temporary rock barrier across False River, west of Franks Tract. This emergency drought barrier blocked tidal flows and successfully prevented saltwater intrusion into the Central Delta. The Department of Water Resources installed 10 new water quality monitoring stations and commissioned a detailed study to confirm the barrier's effects on hydrodynamics and water quality but did not have the capacity or a mandate to study ecological effects of the project. The Delta Science Program funded and coordinated a collaboration with scientists from state and federal agencies and universities to fill this gap.

Researchers examined the ecological consequences of the barrier, including impacts on water conditions, aquatic vegetation, and invertebrates. Scientists found that the barrier (a) allowed submerged aquatic vegetation to spread, (b) influenced the distribution of invasive clams, and (c) had local impacts on copepod transport. The barrier did not cause harmful algae blooms (*Microcystis*) or cut off Delta Smelt from their upstream food supply. Most of the ecological changes that were observed returned to normal soon after the barrier was removed. However, cutting off the intense jet of water that enters Franks Tract from False River allowed invasive aquatic vegetation to colonize the area, and the invasive plants persisted after the barrier was removed. For future barriers, it is important that managers anticipate, proactively manage, and mitigate for increased spread of aquatic vegetation.

In the Delta Plan, salinity control barriers are discussed as a means to secure a reliable water supply in the Delta in Chapter 3, and salinity issues are addressed in Chapter 6. Barriers of any kind will have ecological impacts, including effects on migratory species (Chapter 4). This study adds insights into the complicated issue of salinity management and barriers. For future studies, reference or baseline conditions are recommended to differentiate drought and barrier effects and to improve planning and management decisions for long-term changes to this dynamic ecosystem.

Delta Invasive Species Symposium: Remote Sensing Applications for Management.

On August 29, the Delta Science Program co-hosted a symposium at U.C. Davis with the Delta Interagency Invasive Species Coordination (DIISC) team, focusing on the application of remote sensing technology for the management of invasive species. The DIISC team was established in 2013 to promote coordination on invasive species issues and is made up of staff from state and federal agencies, as well as other stakeholder organizations. This was the third bi-annual Delta invasive species symposium and was sponsored by the DIISC team, Delta Science Program, U.C. Agriculture and Natural Resources Cooperative Extension, the Freshwater Trust, and U.C. Davis.

The purpose of this event was to highlight existing remote sensing efforts related to invasive species, discuss challenges and opportunities, and further conversations to build a collaborative, robust remote sensing toolbox for invasive species monitoring. The one-day symposium included presentations by agency staff, academic researchers, and private consultants that focused on a range of remote sensing tools, such as satellite and aircraft-based imagery and unpiloted aerial vehicles (e.g., drones).

Some key takeaways of the event included:

- Remote sensing data collection and processing is costly, but collaboration can lead to much greater efficiency; and
- Coordinated, Delta-wide remote sensing data will be useful for multiple applications, including aquatic vegetation, agriculture, water quality, and more.

A video recording of the symposium is available on the Delta Conservancy's DIISC Team webpage http://deltaconservancy.ca.gov/delta-invasive-species-symposium/.

COMPASS Science Communication Training

On September 24, staff across all Council divisions attended science communication training provided by COMPASS, an organization that was founded to improve communication between scientists and stakeholders.

The first part of the training consisted of reviewing science communication basics and the messaging needs of different audiences. The second half was interactive, with each participant working on a message they wanted to craft for a particular audience. Staff learned how to use a tool called the "Message Box" to focus and simplify messages so that they were clear and concise. Instructors with expertise in politics and journalism then put staff members in role-playing scenarios where they practiced delivering their message in a low-stakes environment.

Staff who completed the training gained confidence in conveying complicated science issues and learned a new toolset to better focus messages for future delivery to a wide range of audiences, including decision-makers, interagency groups, and stakeholders.

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 was released on October 3, 2019. The ongoing program funds graduate and post-graduate students to conduct research in the Bay-Delta on high priority issues identified in the Science Action Agenda. The application period will close on December 20, 2019.

Thresholds and Restoration Symposium:

This symposium, hosted by the Delta Science Program and the Coastal and Marine Sciences Institute at U.C. Davis, will be held Nov. 19, 2019. The development of restoration sites is not predictable and may not always lead to the development of a targeted ecosystem. Rather, restoration can be affected by unpredictable factors or

thresholds, leading to the development of different ecosystem conditions. The aim of this symposium is to bring together scientists who study restoration development in practice and theory, and restoration managers. By promoting dialogue, the symposium will foster better understanding between scientists and managers, and improve natural resource management. Registration to the public event is currently open.

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: Visual abstract on salmon life-cycle modeling

Attachment 2: Ecological Effects of the 2015 Emergency Drought Barrier (provided at the Countil Meeting)

Attachment 3: Delta Smelt: Biology and Management 101 (provided at the Council Meeting)

Attachment 4: By the Numbers Summary (provided at the Council Meeting)

Contact

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