



Lead Scientist's Report

Summary: Delta Lead Scientist Dr. John Callaway will present an article from the *Nature: Scientific Reports* on the life history of Delta smelt and an article from *Fisheries* on hatchery salmon releases, discuss the draft social science strategy, cover announcements and upcoming events, and provide the *By the Numbers Report*.

Complex life histories discovered in a critically endangered fish. J.A. Hobbs, L.S. Lewis, M. Wilmes, C. Denney, and E. Bush. *Nature: Scientific Reports*. November 2019.

Successful management and conservation of endangered species require comprehensive understanding of a species life cycle and habitat use. For years, Delta smelt have been considered to be a “semi-anadromous” species, i.e., they reproduce in fresh water, while migrating to feed and grow in brackish water. However, recent analyses indicates that some individuals may spend their entire life in either fresh water or brackish water, rather than being semi-anadromous. Researchers from UC Davis investigated Delta smelt life histories for this paper.

The researchers used isotopic signatures in fish otoliths (or ear bones) to identify the water salinity that individual Delta smelt were exposed to throughout their life. This information allowed the researchers to differentiate three distinct life histories for Delta smelt: freshwater residents, brackish water residents, and semi-anadromous fish. Most individuals were semi-anadromous (81%), followed by freshwater residents (12%), and brackish water residents (7%). Species with multiple life history strategies may be more able to adapt to environmental changes, as particular life histories will benefit under different environmental conditions. Protection of the diversity of life histories through incorporation into future management and restoration plans may help Delta smelt survive in a future, changing environment.

The management of Delta smelt has a major effect on Delta water operations, in particular pumping restrictions to reduce entrainment of Delta smelt when they are present in the central and south Delta, and directly relates to the coequal goals. Better understanding of the species life history will improve water management and benefit both ecosystems and people. While the amendment to Chapter 4 of the Delta Plan highlights the importance of ecosystem management rather than management for single species, Delta smelt and other key species are still critical to the overall management of the Delta ecosystem. Improved understanding of Delta smelt life histories will help decision-makers choose where to effectively plan restoration to enhance Delta smelt populations in accordance with Action Area 3 of the Science Action Agenda.

Eight decades of hatchery salmon releases in the California Central Valley: Factors influencing straying and resilience. A.M. Sturrock, K.M. Cervantes-Yoshida, E.R. Huber, H.J.W. Sturrock, S. Nusslé, and S.M. Carlson. *Fisheries*. September 2019.

Hatchery releases are widely used to increase fish populations, with millions of hatchery fall-run Central Valley Chinook salmon released each year. Juvenile salmon from hatcheries can be released at the hatchery or transported downstream by truck and released closer to the ocean. There are trade-offs across these approaches with increased survival for fish that are released further downstream, but also increased straying, where adult salmon do not return to their home river. Straying can have negative impacts on natural populations, but the extent of these impacts are not well understood.

Researchers looked at historical data for returning fall-run Chinook salmon from five hatcheries in the Central Valley from 1940 to 2016 to evaluate the changes in hatchery management practices over this time and potential impacts on natural populations. They found that the timing of hatchery releases has constricted over time, which may limit the ability of salmon populations to respond to future variable climate conditions. Increased straying and the mixing of fish across different rivers have decreased genetic diversity of both hatchery and natural populations and further restricted the ability of fish to survive changes in the environment or disease events. Trucking and other hatchery approaches create advantages for hatchery fish and can deplete the natural population.

The conclusions of this paper relate directly to issues discussed in the amendment to Chapter 4 of the Delta Plan on fisheries management and to recommendation ER R8 of the Delta Plan for managing hatcheries to reduce genetic risk. Although no simple solutions exist, this paper identifies trade-offs in releases that will inform future hatchery management decisions to promote abundance and long-term sustainability of fall-run populations. The paper also highlights the value of leveraging and synthesizing historical data, an objective of the Delta Science Plan and Science Action Agenda.

Social Science Task Force: Draft Report Released

The Delta Social Science Task Force (Task Force) was convened in 2018 and charged with developing a strategic plan to strengthen and integrate social sciences into the science, management, and policy landscape of the Delta. Improvements in social science research have been called for by the Delta Independent Science Board (Delta ISB), and are also highlighted in the Science Action Agenda. Social science research provides insights into why people make decisions that affect natural resources and the environment. Social science tools and knowledge can also improve our communication efforts and our ability to affect change in management and policy decisions, by improving understanding of institutions, and the social and psychological context of decision making. Some examples of social science research questions highlighted in the Task Force's report include: "what format is most useful to communicate scientific lessons from past drought management actions to inform future management?" or "what values, attitudes, and prior experiences influence farmers' adoption of a riparian buffer strategy?"

The effort is a collaboration between the Delta Science Program and the Coastal and Marine Sciences Institute at UC Davis. Two public workshops were held in 2019. The first workshop introduced the Task Force to key agency efforts and management challenges in the Delta, and the second workshop focused on the use of social science research to inform management challenges in the region.

The Task Force released a draft report on December 23, 2019, and it is available here: <https://deltacouncil.ca.gov/delta-science-program/delta-social-science-task-force>. The three findings and nine recommendations in the report focus on three areas to strengthen social science research in the Delta: the need for integrated research and indicators, building capacity for research within agencies and beyond, and addressing institutional structures and processes. Comments on the draft can be sent directly to the Task Force members (socialsciencetaskforce@gmail.com) until January 31, 2020. The final Task Force report is expected to be provided in March 2020.

On your radar

These are some events and initiatives that have recently occurred or will be occurring to keep in mind:

eDNA Symposium:

The Environmental DNA (eDNA) Symposium will take place January 29, 2020. This symposium, sponsored by the Council along with UC Davis and the Department of Water Resources and Metropolitan Water District, will focus on techniques and technology that are used to assess eDNA, or genetic material found in environmental samples that has not come directly from organisms. Scientists and stakeholders will discuss best practices for eDNA research as technological advances continue and challenges arise. A registration link is now available at <https://marinescience.ucdavis.edu/events/upcoming-events/edna>.

Integrated Modeling Workshop:

The Delta Science Program has highlighted value of integrated models in the Delta, including the establishment of the Integrated Modeling Steering Committee (IMSC) in 2017. As part of this effort, the Delta Science Program contracted TetraTech to produce a synthesis report summarizing existing Delta modeling and identifying recommendations for a strategy to further modeling efforts in the Delta. On February 13, 2020 the Science Program will host a workshop to discuss the recent report. The workshop will seek buy-in from Delta modelers and model users on the report findings, and identify priority recommendations and actions from the report.

Connectivity Symposium:

Ecological connectivity describes how adjacent ecosystems allow for the movement of water, nutrients and other materials, fish, and wildlife. In estuarine systems, connectivity is key to understanding and managing how ecosystems will adapt and shift in the face of climate change and sea-level rise. The symposium will bring awareness and

stimulate further thinking in the science and policy communities about the different aspects of connectivity in the San Francisco Estuary and other similar systems. The symposium will take place on February 18, 2020, and more information is available online at <http://deltacouncil.ca.gov/pdf/2019-12-19-estuarine-connectivity-symposium-flyer.pdf>.

Science Needs Assessment Workshop:

In early 2019, the Delta Independent Science Board (Delta ISB) called on the Delta Plan Interagency Implementation Committee (DPIIC) to initiate and lead a bolder, forward-looking science program that provides policy-makers and managers with scientific information to address long-term, emerging issues for the Delta. With DPIIC's endorsement, a workshop is scheduled for April 2020 to develop a science needs assessment for forward-looking science to address complex problems associated with climate change.

Other:

- The Delta Science Program along with California Sea Grant will soon be advertising a new joint position for a Sea Grant Extension Specialist focusing on Delta social science issues. The position will be housed at the Council to work on emerging social science issues, including the implementation of recommendations from the Social Science Task Force.
- Next month we will begin welcoming the 2020 class of California Sea Grant State Fellows. Fellows serve in each of the units of the Delta Science Program and in the Planning Division. Fellows work on individual and unit-based projects that contribute to the Delta Science Program's and this year's priorities, while also learning about the intersection of science and policy.

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: Life History Strategies of Delta Smelt Visual Abstract

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