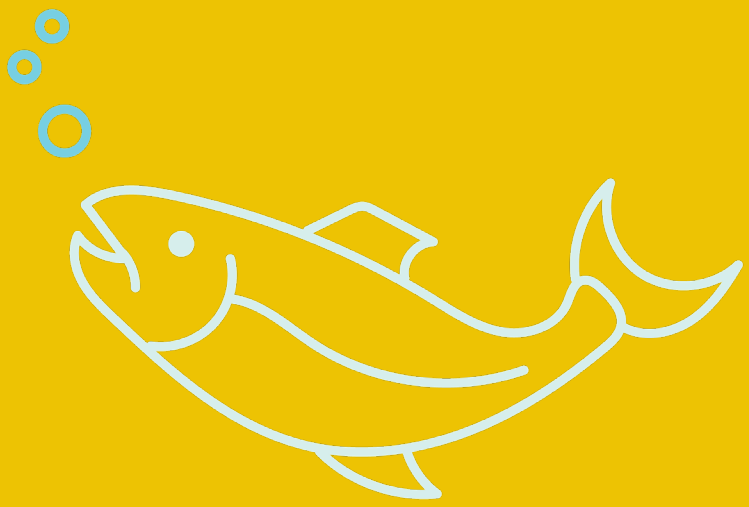


SWC SCIENCE REPORT

2024-2025

SCIENCE = SOLUTIONS

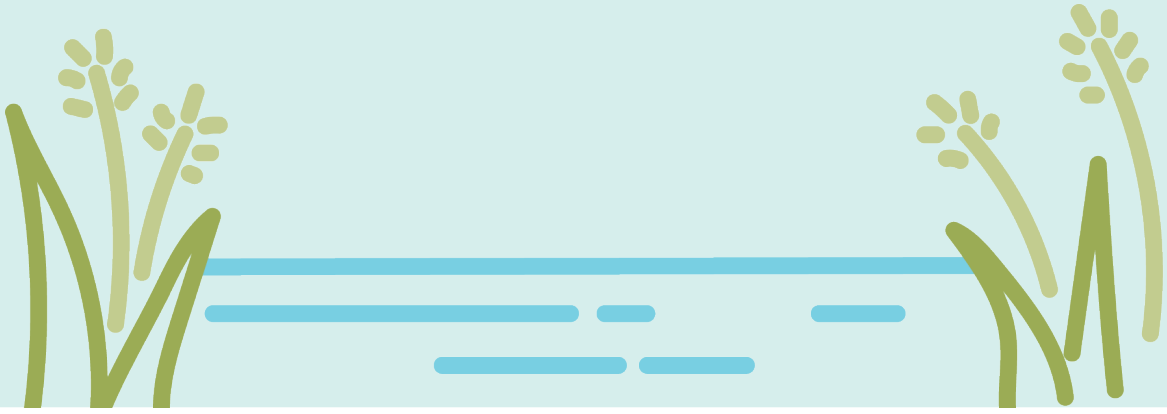
PROGRAM MANAGER'S NOTE

Every year, I have the privilege of overseeing scientific investments on behalf of the State Water Contractors (SWC) and our members. The SWC Science Program is driven by one goal: to advance the state of management-relevant water science in California.

Since the start of the program in 2018, the SWC has funded over $16 million in studies, models, tools and science development, which has contributed to a better understanding of ecosystem function and key water management questions that impact water supply allocation decisions in the Sacramento-San Joaquin Delta (Delta) and throughout the State Water Project system. This work has created ongoing, collaborative partnerships with some of the leading scientists and researchers at universities, state and federal agencies, water agencies and private institutions.

In the most recent fiscal year, our program invested $3.2 million to support several new and ongoing projects. Many of these projects are multi-year undertakings, but all have shown encouraging signs of progress over the past year. We are proud to present the state of the SWC Science Program in this annual report. Here's to another year filled with water science and partnership.

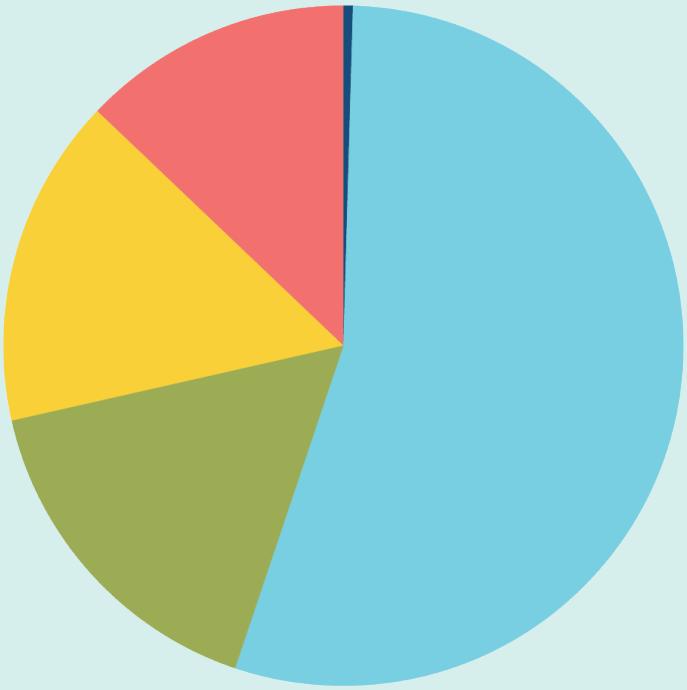
Darcy Austin
SWC Science Program Manager



SWC SCIENCE FUNDING BY PROGRAM OBJECTIVE

FY 2024-25

- **<1%** Compliance
- **13%** Science Development
- **16%** Outflow
- **16%** Non-operational Stressor Reduction
- **55%** Habitat and Ecology



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FROM PROPOSAL TO PROGRESS: UPDATES FROM THE SWC 2023 SCIENCE SOLICITATION

In 2023, the State Water Contractors (SWC) launched its first competitive science solicitation to advance understanding of the San Francisco Bay, the Delta and upper watersheds, consistent with the SWC Science Program objectives. The request for proposals emphasized studies of secondary (non-flow) mechanisms affecting Delta and Longfin Smelt, Chinook Salmon and Central Valley steelhead.

In August 2023, in partnership with the California Department of Water Resources (DWR), SWC awarded more than $4 million to six projects. The funded studies were designed to generate actionable science that supports fish and habitat protection while sustaining a reliable water supply for 27 million Californians and 750,000 acres of farmland.

Considerable progress has been made in the six funded studies, as proposals have been transformed into management-relevant science. While all six studies continue to move towards completion, this report highlights progress made on three studies, two of which received supplementary funds in the past fiscal year to refine their data for publication.

What is Management-Relevant Science?

Management-relevant science in water planning involves the application of interdisciplinary research and methodologies to effectively support decision-making in water resources management.

By integrating scientific knowledge with actionable, science-based management strategies, California can tackle ecosystem and species challenges in the Delta and beyond.

Applying a Response Spectrum Model to Assess Spatial and Temporal Differences in Effects of Pesticide Mixtures on Juvenile Chinook Salmon in the Delta

Richard Connon, UC Davis
2023 award: $525,719 | SWC Objective: Habitat and Ecology

This study uses a response spectrum model to assess spatial and temporal differences in the impacts of pesticide mixtures on salmon rearing in the Delta. The model enables prediction of the sub-lethal (e.g., behavioral and physiological) effects of pesticides in juvenile Chinook salmon from measurements of pesticide concentrations in fish tissues. Findings to date suggest that the fish are impacted by pesticide loads, possibly making them more vulnerable to predators.

Why it matters: Several legacy and current-use pesticides in water, sediments and invertebrates pose substantial risks for juvenile Chinook salmon rearing in the Delta. Although pesticides are known to be present in juvenile Chinook salmon and their invertebrate prey in the Delta, the nature and severity of the effects of pesticide mixtures on fish, as well as the spatial and temporal variability in those effects, are unknown.

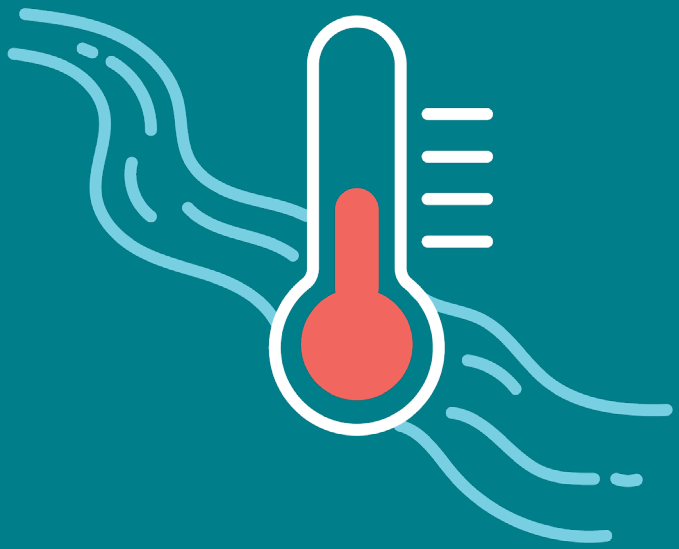
This study's findings to date indicate that concentrations are at thresholds that can lead to mortality of fish, either directly or indirectly, which should be taken into consideration when developing actions to protect listed species.

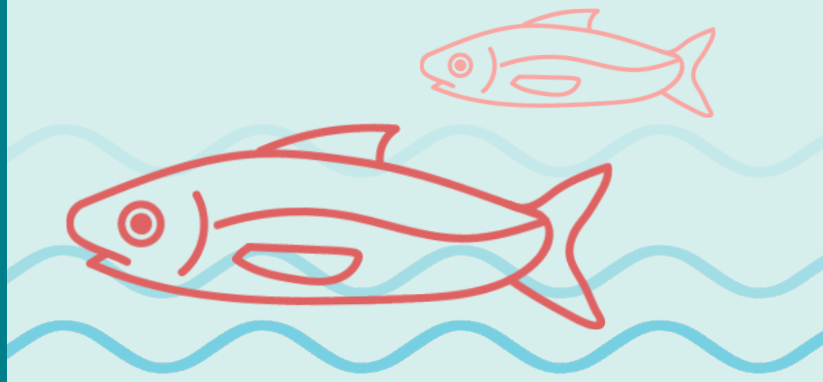
Predicting and Managing River Temperatures for Salmon Under Current and Future Climates

Erin Bray, San Francisco State University
2023 award: $339,311
2025 supplemental award: $130,000
SWC Objective: Habitat and Ecology

This study is developing a model to predict river temperature fluctuation. Being able to predict changes in river temperatures is pivotal to protecting temperature-sensitive salmonids under today's conditions and changing climate. In 2025, the SWC provided a $130,000 supplement to enhance the study, focusing on the impacts of warming rivers downstream from reservoir releases. The additional funding will allow the model to better track how sunlight heats muddy, sediment-rich water, improving predictions of river temperatures.

Why it matters: Temperature is a major stressor for salmon and steelhead. By understanding how the release of sediment-laden water can impact downstream river temperatures, operators and resource agencies will have a stronger tool to explore management options — such as release timing, blending strategies or habitat actions — that keep temperatures within protective thresholds.





Salmonid Movements and Distribution Near South Delta Export Facilities

Michelle Havey, Anchor QEA (previously led by Michael MacWilliams)
2023 award: $340,750
2025 extension: $56,000
SWC Objective: Habitat and Ecology

Juvenile Chinook salmon and Central Valley steelhead face high mortality as they navigate the Delta on their path to the ocean. This study examines how environmental and hydrodynamic factors, including flow, turbidity, temperature and the percentage of source water, influence salmonid behavior and distribution near the State Water Project (SWP) and Central Valley Project (CVP) export pumps.

As of spring 2025, the team has completed most of its analysis using existing fish-tracking and water-flow data and is drafting the report and journal papers. The SWC funded an additional $56,000 in 2025 to complete additional data processing, model development and revisions to the study in response to feedback from SWC staff and partner agencies. The researchers plan to publish two peer-reviewed journal papers to strengthen scientific credibility and increase the likelihood that fish agencies will apply the findings.

Why it matters: Understanding when and where environmental conditions elevate risk near the export facilities helps managers make better decisions. The anticipated two-paper approach will increase visibility in national journals and support broader adoption of the study's insights in state and federal decision processes.

SWC SCIENCE = SOLUTIONS

Additional management-relevant research funded by SWC provides an essential scientific basis to advocate for sound, responsive policy. Below are a few examples of how SWC-funded science is poised to address current challenges in water management:

Accounting of Delta Diversions for More Accurate Water Accounting

Letitia Grenier, Public Policy Institute of California (PPIC)

Challenge

Every year, California's water managers must administer complex water rights while balancing the competing needs of water for the ecosystem, for people to use and drink and for agricultural irrigation. With climate change making water supplies more unpredictable every year, it has never been more crucial for water managers to allocate California's precious and finite water resources accurately.

California's current water accounting system has a number of gaps, which makes this tough job nearly impossible. The shortcomings of the state's water accounting system were highlighted in 2021, when millions of acre-feet of water could not be accurately accounted for — hindering efforts to manage flow and water quality in the Sacramento-San Joaquin Delta. Gaps in California's water accounting capabilities have enormous economic consequences and create opportunities for heightened tensions and misinformation.

Project

To address these issues, the PPIC Water Policy Center, the California Water Data Consortium and the UC Davis Center for Watershed Sciences have embarked on a two-year project. The project builds upon PPIC's 2016 Accounting for California's Water and California Water Data Consortium's (CWDC) "Putting Data to Work" reports to assess current gaps in water accounting and reporting, propose innovative, tech-enabled solutions and highlight case studies demonstrating the benefits of improving water accounting.

This two-year project is being co-funded alongside a coalition of foundations, agencies, water users and NGOs. Key findings and policy recommendations will be released by fall of 2027.

Sara Nevis / California Department of Water Resources

Delta Smelt Cultivation Comparison
Florian Mauduit (UC Davis)

Challenge
Conditions in the 2024 Biological Opinions and the SWP's Incidental Take Permit for long-term operations require DWR to implement the Delta Smelt Supplementation Program (Supplementation Program) and evaluate the efficacy of supplementation methods. The Supplementation Program is a multifaceted approach to studying and addressing various factors that impact Delta Smelt, with the goal of developing a captive breeding program to support the persistence of Delta Smelt in the wild.

A captive breeding program initiated by the UC Davis Fish Conservation and Culture Laboratory (FCCL) has seen success in producing Delta Smelt to augment the existing population, but challenges remain. So far, raising Delta Smelt in captivity has proven expensive, and the resulting fish, which are acclimated to a laboratory environment, may not be as well-suited for survival in the wild. Investigators are evaluating an alternative method for fish rearing that could provide an additional source of Delta Smelt for the Supplementation Program — advancing new ecosystem and water management information through SWC-funded science.

Project
To investigate whether it's possible to improve post-release survival rates and overall fish production of lab-raised smelt, researchers are investigating the possibility of using rearing enclosures at a facility on Metropolitan Water District's Bouldin Island to expose Delta Smelt to natural environmental conditions, including predators, and conduct experiments to measure their fitness for survival.

As part of this project, researchers intend to develop a method for natural spawning within the impoundment. If successful, this work could lead to more cost-effective methods of rearing Delta Smelt with improved odds of survival in the wild.

Genetic and Life History Resilience in Spring-Run Chinook Salmon
Flora Cordoleani (UC Santa Cruz)

Challenge
Regulations for the protection of Chinook salmon populations can limit the ability to capture water for storage during short, intense storms.

This limitation is often in place due to a stated desire to preserve flows for Chinook salmon and other fish populations, based on the hypothesis that it will improve survival rates. However, Chinook salmon life cycle models require additional nuanced information to refine our understanding of their life histories, biodiversity and how their use of different habitats under different flow conditions impacts their survival.

Findings from SWC-funded science research projects like these provide insights into the Chinook salmon population which ultimately help address water management challenges.

Project
This study aims to deepen our understanding of biodiversity and life history information, which is critical for the conservation of spring-run Chinook salmon.

Through the analysis of otoliths, eye lenses and tissue samples, researchers can assess migratory strategies, habitat use, and other life history information across multiple natural water systems. This information can help predict how spring-run Chinook salmon may respond to different conservation and management strategies, such as pulse flows and the use of floodplain and rice field habitats.

The study builds upon a long history of Chinook salmon-related initiatives funded by the SWC and aligns closely with modeling by the Reorienting to Recovery effort, potentially leading to actions to be taken as part of the Healthy Rivers and Landscapes initiative and other habitat restoration efforts.

SHARING WHAT WE LEARN

The SWC Science Program is always focused on informing actions that improve California's water policy and regulatory landscape, driven by the best available science. To do that, we collaborate with partners and share findings with decision-makers at forums throughout the state — extending the impact of the science we support.

Our Outreach and Collaboration This Past Year Included:

Supporting the Delta Science Program's Solicitation: The State Water Contractors supported the Delta Stewardship Council's Delta Science Program solicitation by helping to fund two studies.

Bay Delta Science Conference – Fall 2024: Darcy Austin participated on a panel to share experiences in collaborative science in the Delta, which included state contractor perspectives on participation in the Collaborative Science and Adaptive Management Program.

National Conference on Ecosystem Restoration: Darcy Austin participated on the planning team for this national forum, which brought together ecosystem restoration professionals from across the country, and presented on the unique issues facing the Estuary and Delta watersheds.

CNRA California Salmon Strategy Roundtable: Jennifer Pierre and Darcy Austin participated in the California Natural Resources Agency's roundtable that focused on areas of progress and ongoing challenges in restoring natural populations of Chinook salmon in California.

DWR/COEQWAL Participation: Jennifer Pierre and Darcy Austin brought much-needed perspectives from the water user community to this collaborative effort to envision future water management under a changing climate.

Water Management Decision-Making Presentations: Darcy Austin, alongside colleagues from member and partner agencies, presented to several agencies on how SWP science is used in water management decision-making.

California Water Data Consortium Summer Roundtable: Darcy Austin presented State Contractor perspectives on the importance and limitations of data for managing the balance between maintaining a reliable water supply for Californians and the needs of the ecosystem.

Healthy Rivers and Landscapes – Science Committee: Darcy Austin's committee membership ensures SWC members have an advocate for science-based policy in discussions about shaping the Healthy Rivers and Landscapes Program with the California Water Board.

LOOKING AHEAD

2026 SWC Science Spring Symposium: The 2026 Spring Symposium will showcase talks and discussions on how contaminant data can be used to support the management of listed species. Today, management of listed species tends to focus on water management activities (flows and water operations) without considering how contaminants may be impacting the species. And management of contaminants tends to focus on source control of individual contaminants, which doesn't fully capture the effects on listed species.

This symposium will focus on developing a pathway towards effects-based management to reduce the risk of contaminants affecting species. To receive Symposium updates, please email science@swc.org or visit the SWC Science website at: www.swc.org/science.

Science Synthesis Portal: A key goal for the year ahead, the SWC Science Program is developing a Science Portal — a synthesis of SWC Science-funded research — that will be live on the SWC Science website next year. Stay tuned!

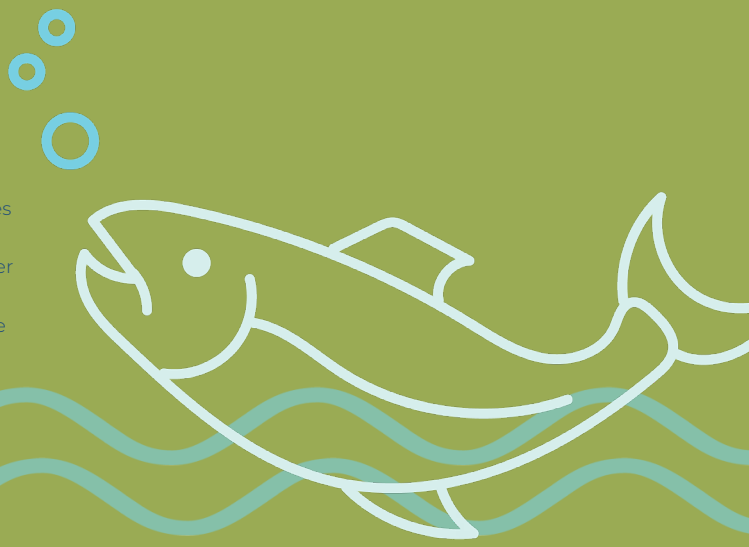
Nerdy by Nature: In 2026, we will launch "Nerdy by Nature," a video series and newsletter where Darcy Austin sits down with researchers to dive deeper into their work. If you'd like to receive updates on this series, sign up here.

@SWC_CAWater

State Water Contractors

www.swc.org/science

The State Water Contractors is a statewide, non-profit association of 27 public agencies from Northern, Central and Southern California that purchase water under contract from the California State Water Project. Collectively, the State Water Contractors deliver water to more than 27 million residents throughout the state and more than 750,000 acres of agricultural land. For more information on the State Water Contractors, please visit www.swc.org.



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