



THE METROPOLITAN WATER DISTRICT
OF SOUTHERN CALIFORNIA

Board Report

Bay-Delta Resources

- **Bay-Delta Science Summary Update**

Summary

The attachments to this report provide a summary of Metropolitan's Bay-Delta scientific accomplishments in Calendar Year 2024. This is the first annual report intended to update the Board on the science achievements of the Bay Delta Initiatives (BDI) group.

Purpose

Informational

Attachments

Attachment 1: 2024 Bay-Delta Scientific Achievements Report

Attachment 2: Metropolitan's Bay-Delta 2024 Scientific Publications

Detailed Report

Science plays a key role in managing the reliability and sustainability of Metropolitan's water resources. With the use of research, Metropolitan is leading the way in water management and informing our policy decisions, regional planning, and regulatory compliance. This is especially important in the Sacramento-San Joaquin Delta. State and federal Endangered Species Act permits are required to use the best-available science to set goals and objectives related to water operations, water quality, and ecosystem habitat. Science is also used to support flexible and adaptive management of water supply infrastructure. For example, scientists from Metropolitan, using years of accumulated research including the work reported in the 2024 Bay-Delta Scientific Achievements Report, recently participated in, and facilitated an evaluation of potential summer and fall water operations that would result in a water savings of approximately 150 thousand acre-feet per year for the State Water Project on average in wet and above normal water years, such as this year. Metropolitan's science program seeks grants to support the work as well as partnering with other entities to ensure costs are shared equitably. In 2024, Metropolitan's research budget was approximately \$3.6 million which enabled more than \$8 million of research to be conducted. Attached to this board report are summaries (Attachments 1 & 2) that highlight some of the key accomplishments of the BDI science program completed in 2024.



2024 Scientific Achievements Report

Bay-Delta Initiatives

THE METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA



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Wildlife in Webb Tract

Leveraging Science for Sustainable, Resilient Water Management

Science plays a key role in managing the reliability and sustainability of Metropolitan's water resources. With the use of research, we are leading the way in water management and informing our policy decisions, regional planning, and regulatory compliance with science. We work with our partners to tackle common challenges.

This is critically important in the Sacramento-San Joaquin Delta, the heart of California's water delivery system, as well as home to a vital ecosystem. Metropolitan-owned lands in the Delta – Webb Tract, Bacon Island, Bouldin Island and Holland Tract – allow us to continue exploring ways Metropolitan can work collaboratively to improve the Delta's declining ecosystem and promote water reliability in a living laboratory.

State and federal regulatory documents such as biological opinions, permits, and water quality control plans use the best-available science to manage this balance between the needs of the environment and needs of communities throughout the state. For example, data on species populations, habitats, and environmental conditions help predict how changes in water flow, temperature, and salinity affect ecosystems.

Science also supports the flexibility of water operations in the Delta, adapting operational rules based on real-time data and new findings, encouraging collaboration across agencies. By partnering with non-profit and private organizations, state and federal agencies, academia, and other stakeholders, Metropolitan's Bay-Delta Initiatives group helps reduce the district's costs, better reflect diverse perspectives, and support broad acceptance of project outcomes.

The team shares their findings on an ongoing basis in various formats, including presentations at meetings, symposia, conferences, and publications in peer-reviewed journals. In 2024, BDI's research budget totalled \$3.6 million dollars, with over 30% of that funding from grants from outside agencies.

2024 SUMMARY OF ACTIVITIES



14
Research Studies
and Projects



14
Presentations



8
Publications



Restoring Chinook Salmon

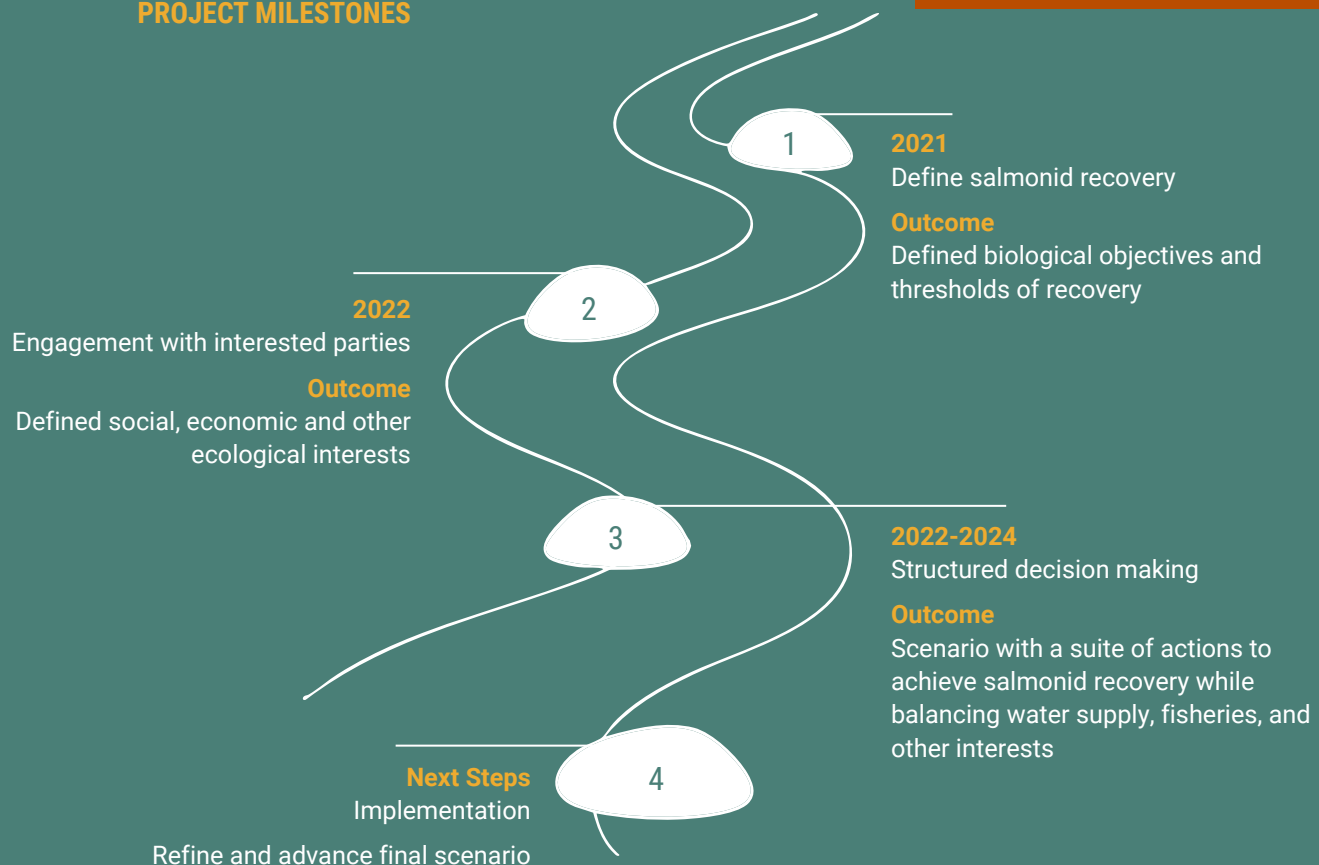
Since 2021, the Reorienting to Recovery California Central Valley Salmonid Recovery Project (R2R) has engaged hundreds of people from state and federal governmental agencies, non-governmental organizations, Tribal Nations, and water, agriculture, and fishing industries to identify an approach to recovering Central Valley Chinook salmon populations to advance multi-benefit solutions that promote a sustainable Bay-Delta, in alignment with Metropolitan's priorities.

This process fostered collaboration among parties with diverse interests and achieved broad support for a final hybrid recovery scenario that meets biological targets while balancing water supply, agriculture, fisheries, and other interests. With broad support, the group, including representatives from Metropolitan, finalized a report recommending a suite of habitat, hydrology, harvest and hatcheries actions to successfully recover salmonids in the Central Valley. These actions must be carried out across a range of water year types – especially dry years – to stabilize and grow populations.

The next phase will focus on refining and implementing this set of actions.

Fun Fact: R2R collected feedback from over 110 agencies.

PROJECT MILESTONES



Delta Smelt and Native Species Preservation

Metropolitan is leading a collaborative effort to preserve Delta smelt and native species in partnership with state and federal agencies and the University of California, Davis. This multi-agency collaboration also helps support the recovery of the Delta smelt population by using innovative and cost-effective breeding methods while gaining strong support from NGOs, academics, and government agencies.

This multi-agency collaboration also helps meet permit requirements, including those for the 2024 federal Biological Opinions and state Incidental Take Permit, to support fish populations.

If these projects are successful, they could present an opportunity for agencies to further invest in the future of the Delta.

For more information, view this video: <https://shorturl.at/yw0Wd>.

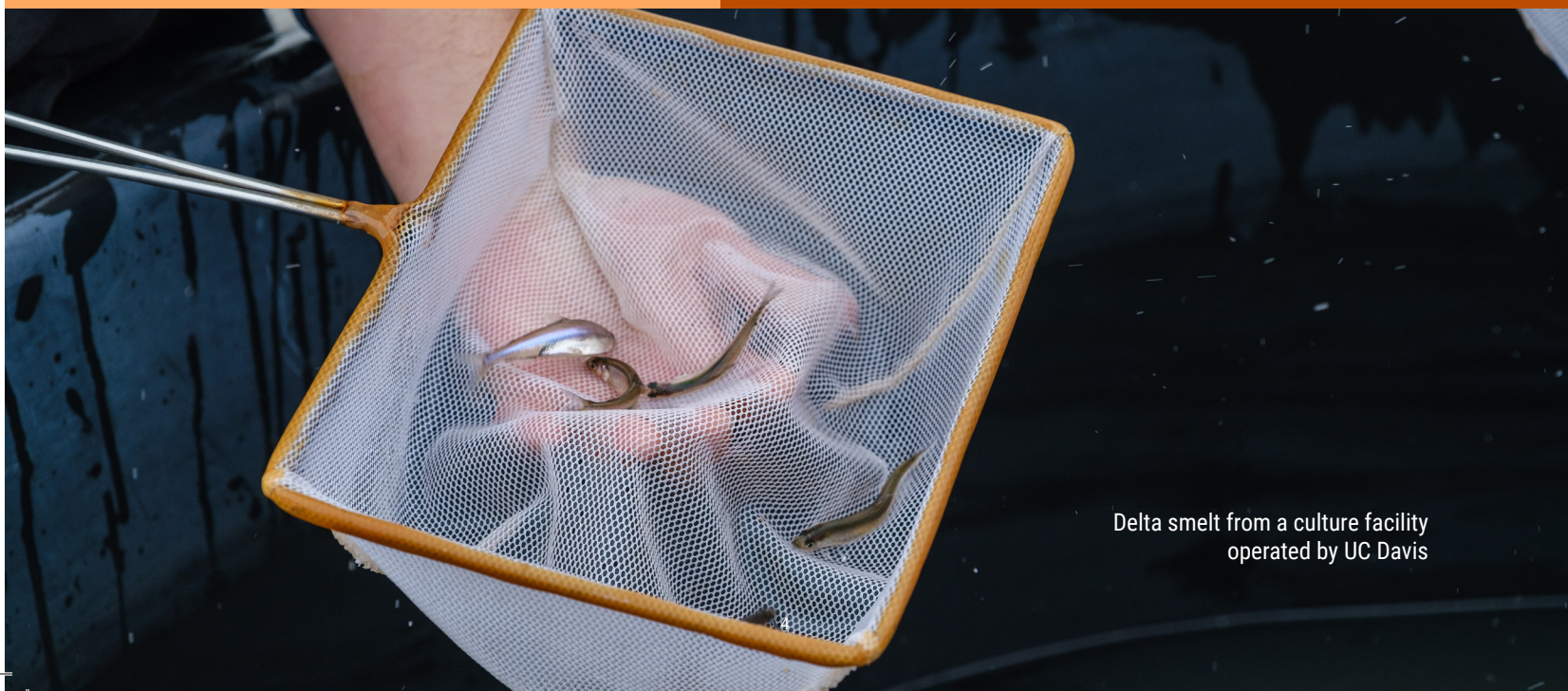
Key Objectives

Metropolitan is helping to provide research and information to help the United States Bureau of Reclamation meet the following objectives:

- Enhance breeding methods to support the survival, spawning, and population growth of Delta smelt
- Achieve a production goal of 350,000 fish annually by 2030, up from the current 100,000 fish in 2024

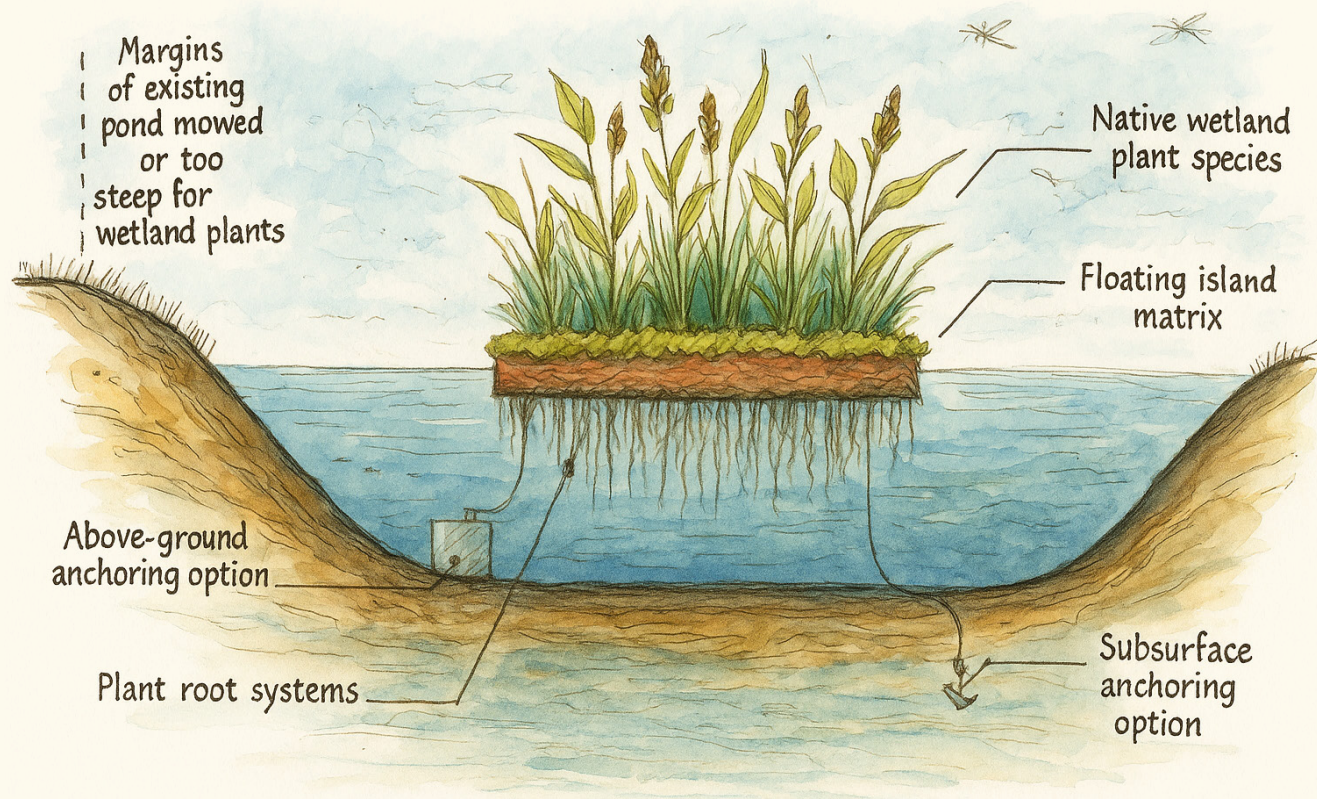
Fun Fact: Metropolitan is the first water agency to study Delta smelt.

Next Steps: Further optimize the pond culture of Delta smelt. Continue to develop the innovative restoration tool of floating wetlands.



Delta smelt from a culture facility operated by UC Davis

FLOATING WETLAND CONCEPT



1. Pilot Pond Study (2022–2023)

- Conducted on Bouldin Island
- Successfully cultured Delta smelt in ponds, demonstrating that pond culture could be a viable low-cost alternative to culturing only using tanks

2. Floating Wetland Cage Study (2024–2026)

- Ongoing research exploring the use of floating wetlands to enhance habitat, food availability, and fish survival
- Secured grant funding to support continued research

3. Pond Harvest Study (Planned for Fall 2025)

- This research investigates the feasibility of pond-based Delta smelt production and optimal harvest techniques
- A successful outcome could facilitate rapid expansion of pond production to meet USBR goals

Multi-Benefit Landscape Restoration on Webb Tract

Webb Tract, a Metropolitan-owned island located in the Sacramento-San Joaquin Delta, presents an opportunity to transform the land from its existing agricultural use to a more sustainable mosaic of rice farming, wetlands, and high-quality habitat. Through two projects - one that focuses on conversion of existing agricultural lands to rice, and the other to create a wetland mosaic that provides diverse habitats for a wide range of plant and animal species - Metropolitan will promote sustainable agriculture and enhanced ecosystem benefits. Together these projects contribute to Metropolitan's mission to provide high quality water in an economically and environmentally responsible way.

Key goals of these multi-benefit projects include halting peat oxidation and reversing subsidence, promoting carbon sequestration, generating sustainable revenue to support land management, and restoring high-quality habitat for wildlife.

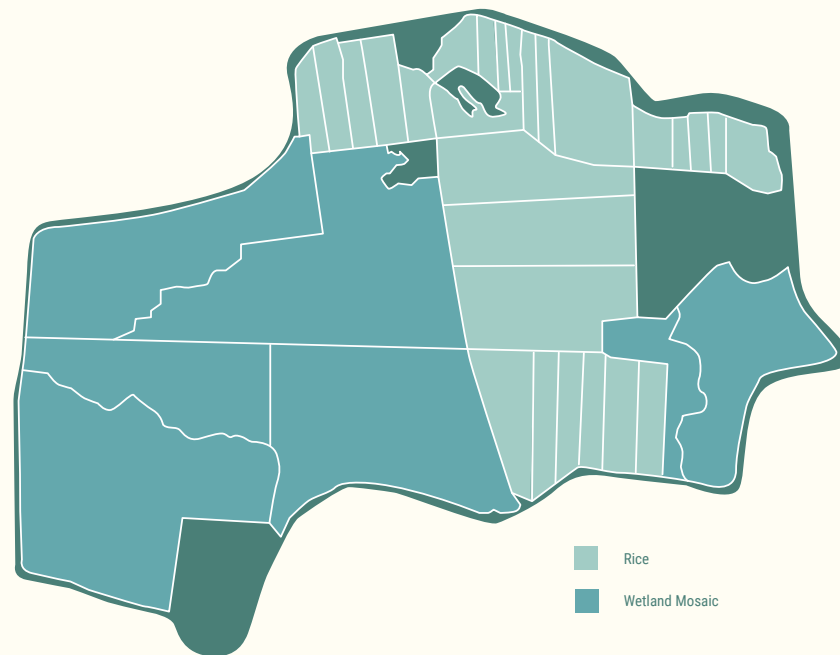
These projects are made possible by a \$20.9 million grant from the Sacramento-San Joaquin Delta Conservancy as part of its Nature-Based Solutions: Wetlands Restoration Grant Program. The grant provides funding to offset the cost of converting existing agricultural practices to rice. The second supports design, permitting and construction of approximately 2,300 acres of wetland on this deeply subsided island. The grant also funds quantification of greenhouse gas emissions before and after construction. The project will incorporate and encourage establishment of native vegetation and include adaptive management strategies to enhance ecosystem benefits.

Project Milestones

- **Spring 2025:** Utilize Cutting the Green Tape Initiative to streamline California Environmental Quality Act and permit approvals for the wetland restoration project
- **Summer 2025:** Award lease agreement for conversion of existing farmland to rice
- **Fall 2025:** Complete project design and advertising construction contract
- **Ongoing:** Continue public outreach and engagement

Webb Tract

WEBB TRACT PROJECTS OVERVIEW



Fun Fact: The Western Pond Turtle, one of the many Delta species these projects seek to support, can only eat underwater because it needs the pressure of the water to swallow the food.



Western Pond Turtle

Bringing Diverse Perspectives to Water Management

Metropolitan is participating in a collaborative research initiative bringing diverse interests together to address the state's most pressing water needs, with a commitment to ensuring historically excluded voices are included in the decision-making process. The Collaboratory for Equity in Water Allocation program is led by researchers from six Universities of California and California State University campuses, working in partnership with state and federal government agencies, Native American tribes, community groups, water districts, and non-profit organizations. By broadening participation and sharing data, the group is focused on empowering all Californians to influence decisions over how water is managed, focusing on challenges such as insufficient water supply, climate change impacts, and the need for balanced distribution among agriculture, urban areas, and the environment.

To kick off the project in 2024, Metropolitan helped fund a project that explores how climates in the future and operations of the State Water Project could affect water availability for the millions of people and industries it serves.

Next Steps: A public website with accessible water planning tools will be released by the end of 2025.

Metropolitan leading a tour of its Delta islands for students from the University of California Water Academy, a program partly funded by the COEQWAL project.



Using Decision Support Tools to Improve Water Management and Outcomes for Fish

Securing a sustainable and resilient Bay-Delta system that supports water supply reliability and ecosystem health often requires making decisions in the face of uncertainty. Structured Decision Making (SDM) tools like Value of Information (VOI) provide decision-makers a quantitative approach for weighing the trade-offs between investing in research to gather more information or proceeding despite uncertainties.

This collaborative project uses VOI to help the U.S. Bureau of Reclamation and its partners, including Metropolitan, identify and prioritize research that will improve outcomes for aquatic species and water supply. To date, the collaboration has held a workshop for technical staff to get hands-on training in VOI tools, implemented VOI in four case studies involving decisions on how to meet requirements for listed fish species within the permits for operating the water projects, and hosted a special session at the Bay-Delta Science Conference showcasing VOI applied to management decisions in the Bay-Delta watershed.

Next Steps: In 2025, staff from Metropolitan, U.S. Bureau of Reclamation, U.S. Fish & Wildlife Service and U.S. Geological Survey will co-instruct a week-long SDM course with topics including VOI for over two dozen technical staff at state and federal resource agencies, NGOs, and public water agencies.

Bouldin Island

Fun Fact: This year, Metropolitan participated in an SDM exercise on State Water Project regulations related to Delta smelt. As a result of this effort, the SWP saved approximately 150,000 acre-feet of water.



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About Metropolitan

The Metropolitan Water District of Southern California is a state-established cooperative that provides water to its 26 member agencies in a service area of nearly 19 million people across six counties. The district imports water from the Colorado River and Northern California to supplement local supplies, and helps its members to develop increased water conservation, recycling, storage and other resource-management programs.

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Metropolitan's Bay-Delta 2024 Scientific Publications

1. [La, C. G., Hartz, K. E. H., Arkles, M., Grim, M. E., Acuña, S., Sadro, S., & Lydy, M. J. \(2024\). A baseline assessment of contamination in the Sacramento deep water ship channel. *Environmental Pollution*, 360, 124606.](#)
Contaminants of concern were detected in the sediment, water column, and prey for Delta Smelt in the Sacramento Deep Water Ship Channel, suggesting multiple hazard routes for toxicity. Previously promoted plans to transport prey from Sacramento Deep Water Ship Channel may further disperse contaminants.
2. [Stillway, M. E., Hammock, B. G., Acuña, S., McCormick, A. R., Hung, T. C., Schultz, A., Young, T., & Teh, S. J. \(2024\). Sub-Lethal Responses of Delta Smelt to Contaminants Under Different Flow Conditions. *San Francisco Estuary and Watershed Science*, 22\(2\).](#)
The study covered a three-year period and evaluated the effects of contaminants on Delta smelt. Results of the study suggest that there may be conflicting effects for wetter years creating low salinity habitat, while also being more toxic to Delta smelt.
3. [Anzalone, S. E., Fuller, N. W., Hartz, K. E. H., Whitledge, G. W., Magnuson, J. T., Schlenk, D., Acuña, S., Whiles, M.R., & Lydy, M. J. \(2024\). The Roles of Diet and Habitat Use in Pesticide Bioaccumulation by Juvenile Chinook Salmon: Insights from Stable Isotopes and Fatty Acid Biomarkers. *Archives of Environmental Contamination and Toxicology*, 86\(3\), 234-248.](#)
The paper discusses the results of our collaboration with Southern Illinois University and UC Riverside on the hazard risk of contaminants on Chinook Salmon in the floodplains or rivers. The results suggest the differences in contaminant profiles are more favorable on the floodplains, further supporting that Chinook Salmon receive benefits from floodplain rearing.
4. [Young, M. J., Feyrer, F., Hassrick, J., Acuña, S., Ayers, D., Donovan, J., & Grimaldo, L. \(2024\). The Influence of Time, Tide, and Place on Fine-Scale Nekton Distribution: Insights from the San Francisco Estuary. *Estuaries and Coasts*, 47\(4\), 1101-1118.](#)
The study involved an intensive set of day and night surveys across the San Francisco Estuary to examine the behavioral and distributional changes by nektonic (upper water column) fish. Fish, including Longfin Smelt distributions were more related to day night cycles being closer to the bottom of the estuary during the day and then more widely distributed during the night. This information has already been incorporated into the listing decision and will be continuously used to develop the Longfin Smelt Lifecycle Model to inform water project operations.
5. [Healy, B. D., Runge, M., Beakes, B., Phillis, C., Jensen, A., & Israel, J. \(2024\). The Value of Information Is Context Dependent: A Demonstration of Decision Tools to Address Multispecies River Temperature Management Under Uncertainty. *Fisheries* 49\(11\), 508–23.](#)
Managing water temperatures in California's Sacramento River is challenging due to the differing needs of two endangered species: winter-run Chinook Salmon, which require cooler waters, and Green Sturgeon, which prefer warmer conditions. A temperature-

control device on Shasta Dam aims to maintain suitable conditions, but uncertainties about the optimal temperatures for each species complicate management decisions. Researchers applied multi-criteria decision analysis and value of information (VOI) methods to assess various temperature management strategies, considering different hypotheses about species responses. They found that the effectiveness of a strategy depends on which hypothesis is accurate and on the priority given to each species' needs. Notably, resolving uncertainties was most beneficial when management slightly favored Green Sturgeon, highlighting the importance of addressing both scientific uncertainties and decision-makers values in ecosystem management.

6. [Chen, E.K., W.H. Satterthwaite, B.J. Kormos, R.C. Johnson, C.C. Phillis, & S.M. Carlson. \(2023\). Age Structure of Natural versus Hatchery-Origin Endangered Chinook Salmon and Implications for Fisheries Management in California. Marine Ecology Progress Series 723, 37–55.](#)

Endangered Sacramento River winter-run Chinook salmon raised in hatcheries mature earlier than their wild counterparts, leading to a younger overall age structure. This earlier maturation results in hatchery fish spending less time in the ocean, thereby reducing their exposure to fishing compared to wild salmon, which remain at sea longer and face greater fishing pressure. Additionally, hatchery males are less likely to return at older ages, possibly due to differences in natural selection processes. Understanding these maturation differences is crucial for managing fisheries and ensuring the long-term survival of salmon populations.

7. [Cordoleani, F., Phillis, C. C., Sturrock, A. M., Willmes, M., Whitman, G., Holmes, E., Weber, P., Jeffres, C., & Johnson, R. C. \(2024\). Restoring freshwater habitat mosaics to promote resilience of vulnerable salmon populations. Ecosphere, 15\(3\), e4803.](#)

The study examined the effects of watershed restoration on three spring-run Chinook salmon populations in California's Central Valley: Butte, Mill, and Deer Creeks. Post-restoration, Butte Creek salmon, with access to floodplains, showed increased productivity and faster juvenile growth, correlating floodplain inundation with higher adult abundance two years later. Despite this, Butte Creek fish exhibited lower phenotypic diversity and only marginal improvements in population stability, making them more vulnerable to dry years compared to Mill and Deer Creek populations, which benefited from a late-migrating juvenile strategy. The study highlights the importance of restoring diverse aquatic habitats, such as cold-water refugia and floodplains, to support multiple life history strategies, enhancing salmon resilience and abundance amid climate change.

8. [Kirsch, J.E., Peterson, J.T., Duarte, A., Goodman, D., Goodman, A., Hugentobler, S., Meek, M., Perry, R.W., Phillis, C., Smith, L. and Stuart, J. \(2024\) Imperfect Detection and Misidentification Affect Inferences from Data Informing Water Operation Decisions. North American Journal of Fisheries Management 44\(2\), 335–58.](#)

Researchers studied how young endangered winter-run Chinook Salmon near California's Delta Cross Channel are affected by environmental factors and errors in fish detection and identification. They analyzed data from over 14,000 fish sampling efforts between 1996 and 2019. They found that about 5.6% of the fish were misidentified, and the chance of detecting a fish during sampling was less than 30%. These errors can lead to unnecessary gate closures at the Delta Cross Channel, highlighting the need to consider detection and identification mistakes when making water management decisions.