



REGION 9

SAN FRANCISCO, CA 94105

January 10, 2025

State Water Resources Control Board
Division of Water Rights
Attn: BayDelta & Hearings Branch
Submitted via Email: SacDeltaComments@waterboards.ca.gov

Re: Comment Letter – Draft Sacramento/Delta Bay-Delta Plan Updates

The U.S. Environmental Protection Agency (EPA) appreciates the opportunity to comment on the State Water Resources Control Board's (State Water Board) October 25, 2024 Draft Sacramento/Delta Updates to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Watershed (Draft Plan). State Water Board solicitation for Public Comment on the Draft Plan represents a critical step towards amending the Bay-Delta Plan to enhance aquatic life protection, a process that has been on-going since 2009.¹ Once the State Water Board concludes the Plan amendment process, EPA will review and act upon any new or revised water quality standards contained in the Plan pursuant to Clean Water Act (CWA) section 303(c), 33 U.S.C. §1313(c). As appropriate, EPA will also offer government-to-government consultation in accordance with the [EPA Policy on Consultation with Indian Tribes](#) and will consult with the U.S. Fish and Wildlife Service and National Marine Fisheries Service in accordance with Section 7 of the Endangered Species Act.

It is widely acknowledged that the Bay-Delta watershed is in a state of ecological decline, threatening the existence of several native estuarine and anadromous species; recreational, subsistence, and commercial fisheries;² and cultural and spiritual practices central to the identity of Tribes that have relied on the Bay-Delta ecosystem from time immemorial. The Draft Plan includes multiple options to address these concerns, including: incorporation of Tribal Beneficial Use (TBU) definitions and designation of Tribal Tradition and Culture uses; an option to incorporate numeric and narrative flow

¹ See, State Water Resources Control Board. August 4, 2009. Staff Report on the Periodic Review of the 2006 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary. Adopted by Resolution 2009-0065. Water quality standards for the waterbodies covered in the Draft Plan were last updated in 1995. EPA notes that states are required to hold a public hearing to review applicable water quality standards at least once every three years and, if appropriate, revise or adopt new standards. CWA § 303(c)(1); 40 CFR 131.20(a).
² See, Gina M. Raimondo, United States Secretary of Commerce. December 12, 2024 Letter to the Honorable Gavin Newsom. Available at: <https://www.fisheries.noaa.gov/s3/2024-12/CA-Salmon-Determination-2024.pdf>. In 2024 California's commercial and recreational ocean salmon fisheries were closed for the second consecutive year due to near historically low stock abundance forecasts for Chinook salmon runs, resulting in a 100% revenue loss.

criteria for the Sacramento River, Delta, and their tributaries (Sacramento/Delta) for aquatic life protection (referred to as the regulatory pathway in the Draft Plan); and an option to incorporate narrative criteria and voluntary agreements (referred to as the VA proposal in the Draft Plan, also known as Agreements to Support Healthy Rivers and Landscapes) to provide flow and habitat assets in the Sacramento/Delta for aquatic life protection. The Draft Plan does not make a final determination as to how the regulatory pathway and the VA proposal, if adopted, would be integrated. When the State Water Board releases final draft Sacramento/Delta Updates to the Bay-Delta Plan, EPA will review the revised plan to identify what elements in the Plan amendment, including the Program of Implementation, constitute new or revised water quality standards that EPA has the duty to act on pursuant to CWA section 303(c).³

As we have shared in previous comment letters, Tribes in California have been uniquely impacted by the collapse of fish populations, loss of riparian resources, and increasing occurrences of harmful algal blooms (HABs) in the Bay-Delta watershed.⁴ EPA urges the State Water Board to incorporate Tribal (Tribal Tradition and Culture (CUL) and Tribal Subsistence (T-SUB)) and Subsistence Fishing (SUB) beneficial use definitions into the Bay-Delta Plan. EPA also strongly supports the proposal in the Draft Plan to designate CUL uses throughout the Bay-Delta watershed.

EPA recognizes that flow objectives that provide protection of aquatic life uses will also provide protection of CUL throughout the watershed, allowing the Board to move forward with this initial designation expeditiously. The 2023 Draft Staff Report specifically describes the interconnections between flow actions to protect fish and wildlife uses and those needed to support thriving fisheries central to the identity of many California Tribes.⁵ Protection of CUL via proposed flow actions is an important first step, as a watershed-wide designation places tribal uses on equal footing with other beneficial uses addressed by the Bay-Delta Plan.

EPA also encourages the State Water Board to explore site-specific TBU designations in the Bay-Delta Plan. For example, the Bay-Delta Plan does not currently protect existing Tribal ceremonial uses involving activities such as basket material collection and full-body contact in waters. EPA understands that these site-specific designations will require additional information gathering and Tribal consultation and therefore will need to be included in future Bay-Delta Plan updates.

³ California uses the term “beneficial use” to mean “designated use” under the CWA and the term “water quality objective” to mean “water quality criteria” under the CWA. The terms are used interchangeably in this document. Note that narrative criteria are generally established where numeric criteria cannot be established or to supplement numeric criteria. 40 C.F.R. 131.11(b)(2). *See also*, What is a New or Revised Water Quality Standard Under CWA 303(c)(3)? Frequently Asked Questions. Office of Water, U.S. Environmental Protection Agency. EPA No. 820-F-12-017 (October 2012). Available at www.epa.gov/sites/default/files/2014-11/documents/cwa303faq.pdf. The determination as to the scope of EPA’s CWA

303(c) review is critical and cannot be completed in the absence of final plan amendment language.⁴ Title VI Complaint and Petition for Rulemaking for Promulgation of Bay-Delta Water Quality Standards. Submitted to EPA on December 16, 2022.

Available at: <https://www.restorethedelta.org/wp-content/uploads/2022-12-16-Bay-Delta-Complaint-and-Petition.pdf>.⁵ State Water Resources Control Board. September 28, 2023. Draft Staff Report in support of updates to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary (Bay-Delta Plan) for the Sacramento River and Delta watersheds (Staff Report). p. 11-11.

EPA supports the State Water Board’s proposed regulatory pathway to enhance aquatic life protections and notes that it provides a strong foundation for related TBU protections. Scientific research has documented the detrimental impacts that flow alterations can have on aquatic life, such as degrading species distribution and abundance as well as altering the composition and diversity of aquatic communities. Reductions in flow can degrade the physical (e.g., habitat size and connectivity) and chemical (e.g., temperature, salinity, and pollutant concentration) conditions of an ecosystem.⁶ Sensitive species, including salmonids important to many Tribes, are particularly jeopardized during critically dry periods when low flows and increased temperatures occur, impacts that are exacerbated by water diversions. For example, dry conditions occurred in parts of the Merced River, a key salmon bearing tributary to the lower San Joaquin River, during critical conditions between June and October 2022; it was later determined that authorized water diversions exceeded full natural flow during that time.⁷ Successful implementation of the regulatory pathway will ensure that a proportion of natural flows remain in the system at all times of year and in all water year types. The enclosure to this letter provides commentary on the percentages of unimpaired flow that are needed to support aquatic life.

Notwithstanding, restoring water quality in the Bay-Delta watershed sufficient to protect aquatic life and TBUs is a complex problem that requires a broad range of creative solutions that could include elements of both the regulatory pathway and VA proposal. EPA recognizes that elements of the VA proposal will likely improve aquatic life conditions in the Bay-Delta watershed. Specifically, the VA commitments towards salmon habitat restoration represent a positive step towards ameliorating historical degradation of the Bay-Delta watershed. Restoration of salmonid spawning and rearing habitat is an imperative recovery strategy component for these culturally, economically, and ecologically important species.⁸ Recent examples from the upper Sacramento River highlight how strong partnerships between government, non-governmental organizations, and Tribes can lead to successful salmon habitat restoration efforts, and there is a wealth of scientific literature available to help guide future habitat restoration efforts.^{9, 10} EPA is encouraged by the VA proposal’s emphasis on reproducible science and hypothesis testing to ensure habitat assets benefit the target species and notes that more work is needed to incorporate findings from past research on the adverse effects of limited instream flow to adequately protect all aquatic life and related TBUs year-round.^{11,12} The

⁶ Novak *et al.* 2016. Final EPA-USGS Technical Report: Protecting Aquatic Life from Effects of Hydrologic Alteration. U.S. Environmental Protection Agency EPA Report 822-R-156-007. <http://pubs.usgs.gov/sir/2015/5160/> and

<http://www2.epa.gov/wqc/aquatic-life-ambient-water-quality-criteria>.⁷ See, State Water Resources Control Board. January 16, 2024 Letter to NOAA’s National Marine Fisheries Service acknowledging very low flow and dry river conditions in the Merced River during the summer and early fall of 2022. Available at:

https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/docs/2024/2024-01-16-swb-ltr-response-to-nmfs.pdf.⁸ National Marine Fisheries Service. 2014. Recovery Plan for the Evolutionarily Significant Units of Sacramento River Winter-run Chinook Salmon and Central Valley Spring-run Chinook Salmon and the Distinct Population Segment of California Central Valley Steelhead. California Central Valley Area Office.

⁹ Gary Pitzer and Aric Coppola. 2023. Modifying a River Channel to Boost Salmon Productivity. Available at:

<https://storymaps.arcgis.com/stories/3cd0eda519644e839118c71b7985ed33>.¹⁰

Roni, P., Anders, P.J., Beechie, T.J. and Kaplowe, D.J., 2018. Review of tools for identifying, planning, and implementing habitat restoration for Pacific salmon and steelhead. *North American Journal of Fisheries Management*, 38(2), pp.355-376.¹¹ California Natural Resources Agency.

September 6, 2024. Healthy Rivers and Landscapes Science Plan Final Draft. Available at: https://resources.ca.gov/-/media/CNRA-Website/Files/Initiatives/Voluntary-Watershed-Agreements/Draft_VA_Science_Plan.pdf.

attached Enclosure discusses how key provisions of the VA proposal would benefit from additional detail that will facilitate assessment of the transparency, attainability, and adequacy of potential VA assets and base flows on which VA flow assets are intended to supplement. Should the State Water Board adopt a combination of the regulatory pathway and the VA proposal, it is critical that the regulatory pathway serve as a fundamental backstop in the event that a VA is suspended or deemed unsuccessful.

As conveyed in prior comments, while EPA supports the State Water Board in its efforts to amend the Bay-Delta Plan, the ongoing delays in completing these amendments remain a significant concern given the consequences of these delays on ecological conditions as well as Bay-Delta communities.¹³ EPA appreciates the opportunity to inform the State Water Board's rulemaking process and remains committed working in partnership to protect and restore water quality in the Bay-Delta watershed.

Sincerely,

/s/ January 10, 2025

Tomás Torres
Director, Water Division

Enclosure

1. EPA Comments on the October 25, 2024 *Draft Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Watershed*

¹² Michel, C.J., 2019. Decoupling outmigration from marine survival indicates outsized influence of streamflow on cohort success for California's Chinook salmon populations. *Canadian Journal of Fisheries and Aquatic Sciences*, 76(8), pp.1398-1410.

¹³ In 2016, Delta aquatic resource advocates petitioned EPA to initiate a federal promulgation of new Bay-Delta Plan provisions. In 2022, both EPA and the State Water Board received formal petitions for rulemaking to develop water quality standards that are protective of aquatic life and tribal beneficial uses. EPA also received a Title VI civil rights complaint about, among other issues, the delayed Bay-Delta Plan revisions. The federal complaint and petition are pending. *supra* note 4.

Enclosure

EPA Comments on the October 25, 2024 Draft Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Watershed

The San Francisco Bay-Delta's ecosystem and native fish populations are in decline and meaningful recovery will require watershed-wide increases in flow and habitat restoration.¹ Contemporary research highlights the strong connection between flows into and out of the Delta and survival of imperiled Delta species including salmonids (Perry et al. 2018, Henderson et al. 2019, Michel et al. 2019, 2021, Buchanan et al. 2021, 2024) and Delta Smelt (Polansky et al. 2021, 2024), supporting the State Water Board's conclusion that "[t]he best available science suggests that current flows are insufficient to protect public trust resources."² EPA concurs with the State Water Board's conclusion that current flows are insufficiently protective of existing aquatic life designated uses, as well as proposed Tribal Beneficial Uses (TBUs).

Range of Unimpaired Flows under the Regulatory Pathway

The State Water Board's regulatory pathway to incorporate year-round unimpaired flow provisions relies on a compelling body of evidence that identifies the need to restore functional flows into and out of the Delta at all times of year to benefit native estuarine and anadromous fish species integral to a functioning Delta ecosystem.³ In the Notice of Preparation for the Draft Plan, the State Water Board seeks feedback on the unimpaired flow range needed to balance support of beneficial uses protected in the Bay-Delta Plan. EPA agrees that an adaptive management range for unimpaired flow is appropriate because it provides the State Water Board with the flexibility to address changing flow needs in critical times. For example, the adaptive implementation methods would allow the State Water Board to adjust flows at certain times of year to support critical biological needs for specific life stages of sensitive species. Together with a flexible program of implementation, the unimpaired flow provisions and supporting narrative cold water habitat provisions provide transparent and consistent goals that are critical to drive implementation and adaptive management. EPA encourages the State Water Board to prioritize development of Biological Goals for the Sacramento/Delta watershed to provide benchmarks to assess if aquatic life and related TBUs are being supported and to ensure adaptive implementation is based on quantitative biological outcomes.

Current unimpaired Delta outflow estimates from January to June and July to December are 45% and 53% respectively.⁴ Given that current flow conditions are not adequate to protect all designated uses addressed in the Bay-Delta Plan, unimpaired flows greater than 53% may be needed in certain times of

¹ See, Enclosure to EPA's January 19, 2024 Comments on the September 28, 2023 Draft Staff Report in support of updates to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary for the Sacramento River and Delta watersheds. Available at: <https://www.epa.gov/sfbay-delta/epa-comments-sf-bay-delta-water-quality-control-plan>.

² State Water Resources Control Board, August 3, 2010, Development of Flow Criteria for the Sacramento-San Joaquin Delta

Ecosystem, p. 1-2. ³ U.S. EPA, *supra* note 1. ⁴ State Water Resources Control Board. September 2023. Draft Staff Report in support of updates to the Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta Estuary for the Sacramento River and Delta watersheds. Table 2.4-3 Cumulative Distribution of Current Conditions as Percent of Unimpaired Flow in Delta Outflow, 50th percentile.

year to adequately protect aquatic life. A recent analysis of 65% unimpaired flow in the Bay-Delta watersheds showed broad biological benefits for native species listed under the Endangered Species Act (e.g., winter-run Chinook egg-to-fry survival and Delta Smelt population growth) relative to current

conditions.⁵ The same analysis showed that implementation of the VA proposal, which concentrates limited flow contributions to certain times of year and water year type, may result in broadly negative impacts to listed species relative to current conditions. As such, EPA supports adoption of a year-round unimpaired flow objective of 55% at minimum within an adaptive range that will allow for unimpaired flow rates of 65% or higher to be provided when and where necessary for aquatic life and TBU protections.

VA Asset Accounting

Implementation of the VA proposal will introduce significant complexities to account for flow and non flow assets and to ensure that flow assets are delivered in addition to verifiable base flows. The process to provide and account for VA flow and habitat assets should be one that all stakeholders can access and understand. To maintain public trust, EPA encourages the State Water Board and VA parties to provide all flow data, methodologies, and reporting in a publicly accessible format that ensures transparency, reproducibility, and credibility. Ultimately, the State Water Board can and should provide independent regulatory oversight of the water users subject to both the regulatory pathway and the VA proposal, including for monitoring and assessment requirements critical to effective adaptive management.

EPA appreciates the State Water Board’s continued efforts to accurately convey what a final VA may contain, but the VA proposal described in the Draft Plan remains unclear. The success or failure of VA parties to deliver adequate and credible contributions of water to the system and for the program to provide realized benefits to native aquatic species largely depends on an effective accounting and monitoring program. If the State Water Board proceeds with the VA proposal, EPA encourages the State Water Board to coordinate with VA parties, Tribal representatives, and other stakeholders with relevant technical expertise to develop a transparent and reproducible method for accurately determining base flows and tracking VA flow contributions across the Bay-Delta watershed.

Flow assets in the VA proposal must be in addition to base flows required through regulation, flows needed to meet senior water right demands, and “other base flows in the system that may not be required (i.e., compliance buffers, flood flows, uncontrolled flows, hydropower generation flows, and other flows that would have been present absent VAs).”⁶ The Draft Plan and Appendix E of the VA Parties’ Draft Strategic Plan⁷ describe conceptually what should be included in the base flow calculation, but the Draft Plan does not explain the method for measuring the suite of flows identified

⁵ U.S. Bureau of Reclamation National Environmental Policy Act Final Environmental Impact Statement on Long-Term Operation of the Central Valley Project and State Water Project. Chapter 12 - Fish and Aquatic Resources; figures 12-1 and 12-4. ⁶ State Water Resource Control Board, October 2024 Draft Water Quality Control Plan for the San Francisco

Bay/Sacramento-San Joaquin Delta Watershed. Chapter 4 Program of Implementation, Section 4.4.10.3 Flow Accounting. ⁷ Healthy Rivers and Landscapes Program. October 10, 2024. Draft Strategic Plan Appendix E – Flow Accounting. Available at https://www.waterboards.ca.gov/waterrights/water_issues/programs/bay_delta/docs/2024/flow-accounting.pdf. Appendix E was developed by VA parties and not provided as part of the State Water Board’s Plan Update documents. However, these documents are integral to public understanding and review of what may be part of the Plan Update.

in the Draft Plan, including regulatory unimpaired flows, and calculating additional VA flow contributions. VA flow calculation must also ensure that VA flow assets are fully allocated and not diverted by other users downstream.

Further, as described by the State Water Board, the current regulatory requirements (e.g., D-1641 and ESA/CESA required flows) are not sufficient to protect aquatic life. The Draft Plan does not yet demonstrate that the VA proposal, coupled with current regulatory requirements, is protective of aquatic life uses.⁸ Additionally, the VA proposal in the Draft Plan does not yet account for new proposed projects (such as Sites Reservoir) that may result in substantial depletion of historical baseline conditions and net reductions to Delta outflows regardless of VA flow asset contributions.⁹ EPA thus encourages the State Water Board to develop and share a fully detailed, quantifiable approach to verify base flows and to ensure that flow assets are credible and implemented to their full extent *before* the VA proposal is considered for adoption.

EPA supports habitat restoration where feasible and supported by design criteria anticipated to provide high-quality habitat. In general, implementation of VA habitat assets should be pursued alongside substantial increases in flows. Habitat restoration with insufficient flow may not be accessible or used by the target species and thus fail to provide anticipated biological benefits (Munsch et al. 2020). An extreme example of insufficient flow was observed in the summer and early fall of 2022 when the Merced River ran dry, eliminating all salmon habitat, including habitat areas that may have been recently restored.

The proposed benefits of VA habitat restoration on fish populations will likely be achieved only if the habitat type or function is limiting species recruitment (Hayes et al. 1996). Accurately accounting for the anticipated benefits of VA habitat assets that addresses recruitment limitations is complicated by an incomplete knowledge of current habitat availability in most Central Valley watersheds. Additionally, an incomplete knowledge of how habitat availability changes across flow conditions exacerbates accounting complications. Although detailed site-specific habitat-flow modelling has been completed in a subset of Central Valley watersheds (e.g., Gard 2009), watershed-wide estimates are partly or completely based on expert judgement¹⁰ and therefore subject to substantial uncertainties. Without careful consideration of these complexities, the modeled benefits of VA habitat assets could be significantly overestimated.

Bay-Delta Monitoring and Evaluation Program

EPA is encouraged by the State Water Board's effort to establish the Bay-Delta Monitoring and Evaluation Program (BDMEP) under its authority to assess compliance, evaluate effectiveness, and inform future Bay-Delta Plan updates. The State Water Board should identify critical monitoring needs in the BDMEP and assess compliance independent of regulated water users but consider input from

⁸ U.S. EPA, *supra* note 1. ⁹ For example, the State Water Board currently has several large pending applications for diversions out of the watershed, including but not limited to the Sites Project Authority Application A025517X01 for 1.5 MAF; the Turlock I.D./Modesto I.D. Application A033277 for 2.7 MAF, and the Merced Irrigation District Application A033098 for 400 TAF. ¹⁰ Central Valley Project Improvement Act, Science Integration Team's supporting resources on habitat availability and Interactive Web Apps at <https://flowwest.shinyapps.io/habitat-modeling-availability/>.

external expertise where applicable and appropriate. In addition, the State Water Board should consider developing similar data quality assurance and annual publication processes that have contributed to the success of programs like the San Francisco Bay Regional Monitoring Program and Southern California Coastal Water Research Project's Bight Regional Monitoring Program.

For over 50 years, regulatory agencies working in the Bay-Delta have relied on the Interagency Ecological Program (IEP) to coordinate the monitoring and evaluation functions associated with regulatory program implementation in the broader Bay-Delta watershed. Long-term data maintained by the IEP has allowed for the evaluation of population trends crucial to understanding long-term impacts of regulatory program implementation of freshwater flows into the Delta and subsequent ecological responses. For example, data from one of IEP's longest running surveys, California Department of Fish and Wildlife's Summer Tow-Net Survey, was used to show that increases in salinity and temperature – critical flow-dependent variables substantially influenced by flow regulations – adversely impact Delta smelt abundance in the upper San Francisco Estuary (Nobriga et al. 2008).

IEP agencies are currently grappling with proposals to alter the scope and organizational structure of the IEP. EPA understands that these changes may lead to a science and monitoring program that is inadequate for understanding long-term efficacy of the Bay-Delta Plan. Given these recent developments, EPA supports the State Water Board proposal for a BDMEP that builds on the long-term studies and data collected under the IEP. EPA expects the BDMEP to be a collaborative space that leverages expertise from other agencies, regulated communities, NGOs, and stakeholders, including Tribal Traditional Ecological Knowledge. This is particularly critical given that the actions before the State Water Board in both the regulatory pathway and the VA proposal rely heavily on flow and biological monitoring and rigorous impact analyses to guide program implementation and adaptive management.

The BDMEP standardized monitoring and special studies will provide reliable data and sound science to water managers, the public, and the scientific community to inform management of the San Francisco Bay Delta. The periodic review processes for the Bay-Delta Plan will provide a mechanism for considering changes to the BDMEP monitoring and special studies requirements in a public and open process. EPA encourages the State Water Board to consider including an annual review process of BDMEP program elements to facilitate coordination across other science programs and state and federal agency monitoring requirements. In doing so, the BDMEP will generate relevant and timely ecological information enabling the State Board to effectively implement the Bay-Delta Plan to protect beneficial uses. EPA recognizes that successful implementation of the BDMEP will depend on cooperation and coordination with partner agencies, and EPA is committed to assisting the State Water Board in this effort.

References

- Buchanan, R.A., Buttermore, E. and Israel, J., 2021. Outmigration survival of a threatened steelhead population through a tidal estuary. *Canadian Journal of Fisheries and Aquatic Sciences*, 78(12), pp.1869-1886.
- Buchanan, R.A., 2024. Route use of emigrating steelhead in a heavily modified river delta. *North American Journal of Fisheries Management*, 44(3), pp.714-734.

- Gard, M., 2009. Comparison of spawning habitat predictions of PHABSIM and River2D models. *International Journal of River Basin Management*, 7(1), pp.55-71.
- Hayes, D.B., Ferreri, C.P. and Taylor, W.W., 1996. Linking fish habitat to their population dynamics. *Canadian Journal of Fisheries and aquatic sciences*, 53(S1), pp.383-390.
- Henderson, M.J., Iglesias, I.S., Michel, C.J., Ammann, A.J. and Huff, D.D., 2019. Estimating spatial–

- temporal differences in Chinook salmon outmigration survival with habitat-and predation-related covariates. *Canadian Journal of Fisheries and Aquatic Sciences*, 76(9), pp.1549-1561.
- Michel, C. J. 2019. Decoupling outmigration from marine survival indicates outsized influence of streamflow on cohort success for California's Chinook salmon populations. *Canadian Journal of Fisheries and Aquatic Sciences*, 76(8), 1398–1410. <https://doi.org/10.1139/cjfas-2018-0140>
- Michel, C. J., Notch, J. J., Cordoleani, F., Ammann, A. J., & Danner, E. M. (2021). Nonlinear survival of imperiled fish informs managed flows in a highly modified river. *Ecosphere*, 12(5), e03498. <https://doi.org/10.1002/ecs2.3498>
- Munsch, S. H., Greene, C. M., Johnson, R. C., Satterthwaite, W. H., Imaki, H., Brandes, P. L., and O'Farrell, M. R. 2020. Science for integrative management of a diadromous fish stock: interdependencies of fisheries, flow, and habitat restoration. *Canadian Journal of Fisheries and Aquatic Sciences*, 77(9), 1487–1504. <https://doi.org/10.1139/cjfas-2020-0075>
- Nobriga, M. L., Sommer, T. R., Feyrer, F., & Fleming, K. (2008). Long-Term Trends in Summertime Habitat Suitability for Delta Smelt, *Hypomesus transpacificus*. *San Francisco Estuary and Watershed Science*, 6(1). doi:<https://doi.org/10.15447/sfews.2008v6iss1art1> Retrieved from <https://escholarship.org/uc/item/5xd3q8tx>
- Perry, R.W., Pope, A.C., Romine, J.G., Brandes, P.L., Burau, J.R., Blake, A.R., Ammann, A.J. and Michel, C.J., 2018. Flow-mediated effects on travel time, routing, and survival of juvenile Chinook salmon in a spatially complex, tidally forced river delta. *Canadian Journal of Fisheries and Aquatic Sciences*, 75(11), pp.1886-1901.
- Polansky, L., Newman, K.B. and Mitchell, L., 2021. Improving inference for nonlinear statespace models of animal population dynamics given biased sequential life stage data. *Biometrics*, 77(1), pp.352-361.
- Polansky, L., Mitchell, L. and Nobriga, M.L., 2024. Identifying minimum freshwater habitat conditions for an endangered fish using life cycle analysis. *Conservation Science and Practice*, 6(5), p.e13124.