

Charge for the Peer Review of New Lines of Evidence for Effects on Fish from the Long-Term Operations of the CVP and SWP

Objective

The intent of this peer review is to provide the U.S. Bureau of Reclamation (Reclamation) with recommendations to improve the methods for evaluating fish and aquatic effects of the long-term operations (LTO) of the Central Valley Project (CVP) and State Water Project (SWP).

The 705-mile long SWP and 400-mile long CVP are complex networks of dams, reservoirs, canals, hydroelectric powerplants, and facilities that deliver clean water to millions of Californians, hundreds of thousands of acres of farmlands, and countless businesses throughout California. LTO of the CVP and SWP seek to provide these services while maintaining water flows sufficient to protect wildlife and water quality in the Sacramento-San Joaquin Delta (Delta).

The lines of evidence for describing effects of proposed LTO actions (Proposed Actions) of Reclamation and the California Department of Water Resources (DWR) on fish and wildlife, water supply, and power generation project purposes include literature reviews, observational datasets, and models. Past evaluations of CVP and SWP water operations have assessed various impacts of diversions (water exports) on listed fish species in the Delta, which include Delta smelt, longfin smelt, spring-run Chinook salmon, winter-run Chinook salmon, steelhead, and sDPS green sturgeon. Impact assessments have typically distinguished between near-field and far-field effects. Near-field effects include fish entrainment and mortality that occur in close proximity to export diversion facilities. Entrainment of listed fish species as well as factors associated with entrainment (exports, turbidity, river inflows, water temperatures) are relatively well understood. In contrast, far-field effects refer to the potential of exports to contribute to mortality even when fish are not near the diversion facilities. Export-induced hydrodynamic changes have been suggested as a driver of far-field mortality caused by project operations. **Where** in the Delta far-field effects occur under different export operations and **how** altered hydrodynamic conditions influence fish in the tidal Delta is a critical uncertainty.

Recently, new lines of evidence have been developed by Reclamation and Contra Costa Water District to inform the impacts of operations of the CVP and SWP on listed fish species (Table 1). These new lines of evidence include literature reviews, particle tracking modeling, life cycle analyses, and entrainment analyses to better understand hydrodynamics and population responses associated with entrainment risk of listed fishes due to CVP and SWP water operations. First, the new lines of evidence refine understanding about the spatial and temporal extent of export-induced hydrodynamic conditions (e.g. magnitude and duration of changes in velocity). Second, the new lines of evidence explore how perturbations in through-Delta mortality affect population-level responses.

A robust peer review of suggested new lines of evidence will inform Reclamation's utilization of best available science to guide Proposed Actions for LTO of the CVP; the new lines of evidence may also be of interest to associated interested parties involved in CVP and SWP management.

Review Panel Membership

The Panel consists of four members whose expertise includes fish biology, population biology, hydrodynamics, hydrology, and modeling. The Panel will address questions based on their expertise and are to provide comments solely based on the scientific information being reviewed.

Panel Format

The review Panel will convene virtually for 1-4 closed teleconference meetings prior to submitting their Panel Letter (see below) to the Delta Science Program (DSP). Reviewers may hold subsequent virtual meetings as needed during the review period. The DSP will coordinate all correspondence between the reviewers, Reclamation, and other members of the Planning Team. The DSP will also coordinate an opportunity for public input to be provided to the Panel midway through the review process. All materials provided to the Panel will be posted on the DSP's peer review webpage.

Panel Letter

The deliverables of the final review will include a Panel Letter that is developed by the entire Panel and will address the review questions based on their expertise. For the letter format, the Panel will use a Delta Science Program template, and the letter shall contain a concise executive summary and a table of contents if the report exceeds five pages. At the conclusion of receiving peer review comments, the Peer Review Lead will submit a final Peer Review Report to Reclamation's peer review website (<http://www.usbr.gov/main/qoi/peeragenda.html>), which will include the Panel Letter and list the comments provided by the reviewers. Reclamation's responses to the comments, including actions the agency will undertake regarding the comment, and reasons the agency believes those actions will satisfy any key concerns or recommendations will be included in the publicly posted materials

Peer Review Materials

Materials consistent with the focus of the peer review will be provided to the peer review Panel and are listed below in no specific order.

Table 1: Review Documents (New Lines of Evidence)

No.	Line of Evidence	New information
1	Contra Costa 2026. Intuitive Quantitative Metrics for Rapid Assessment of Entrainment Risks and Salmonid Responses in The Delta (63 pages)	New model approach for describing effects of diversions on entrainment risk
2	USBR 2026. Summary of Modeling Used to Support the Weekly Delta Real-Time Forecast (192 pages)	New real-time modeling approaches for describing effects of diversions on entrainment risk and fish survival
3	USBR 2026. Assessing Operations and Environmental Conditions on Central Valley Chinook Salmon and Steelhead Juvenile Movement (14 pages)	New modeling to describe juvenile salmonid responses to hydrodynamic changes in the Delta and changes to that hydrology as influenced by operations
4	USBR 2026. Literature Review of Juvenile Survival/Mortality Effects on Adult Populations for California Central Valley Chinook Salmon and Steelhead (55 pages)	Literature review describing effects of Delta mortality sources on adult salmon populations

5	USBR 2026. Smolt-to-Adult and Smolt-to-Salvage Modeling for Central Valley Chinook Salmon and Steelhead (14 pages)	New modeling to describe the impact of operational and environmental variables on survival to adult size
6	USBR 2026. Interactive Object-Oriented Simulation Model for Winter-Run Chinook Salmon Sensitivity Analyses on Delta Mortality (13 pages)	New modeling to describe sensitivity of population measures to impacts of increased Delta mortality
7	USBR 2026. OBAN Sensitivity Analyses on Delta Mortality (21 pages)	New modeling to describe sensitivity of population measures to impacts of increased Delta mortality
8	USBR 2026. Winter-run Life Cycle Model Sensitivity Analyses on Delta Mortality (20 pages)	New modeling to describe sensitivity of population measures to impacts of increased Delta mortality
9	USBR 2026. Population-Level Consequences of Alternative Delta Export Operations for Sacramento River Winter-Run Chinook Salmon: A Life-Cycle Modeling Framework (42 pages)	New model describing population level consequences of alternative Delta export operations
10	USBR 2026. Data and Literature Review on Entrainment Versus Environmental Conditions for Central Valley Chinook Salmon and Steelhead (18 pages)	Literature review and new modeling to describe the impact of operational and environmental variables on juvenile survival

Supplemental Materials

1. USBR 2024a. **Long-term Operation – Biological Assessment. Appendix I Old and Middle River Flow Management.** [Final EIS - Appendix AB-I: Old and Middle River Flow Management](#)
2. USBR 2024b. **Long-term Operation – Biological Assessment Appendix I Old and Middle River Flow Management Attachment I.3 Delta Export Zone of Influence.** [Final EIS - Lines of Evidence - Attachment I.3: Delta Export ZOI Analysis](#)
3. USBR 2024c. **Long-term Operation – Biological Assessment Appendix I Old and Middle River Flow Management – Attachment I.7 ECO-PTM.** [Final EIS - Lines of Evidence - Attachment I.7: ECO PTM](#)
4. USBR 2025. **Long-term Operation – Action 5. Exhibit 5, Entrainment Management.** https://www.usbr.gov/mp/nepa/nepa_project_details.php?Project_ID=54661
5. National Academies of Sciences, Engineering, and Medicine. 2025. **Review of the Long-Term Operations of the Central Valley Project and the State Water Project. Chapter 3 Old and Middle River Flow Management (pages 87-133).** Washington, DC: The National Academies Press. <https://doi.org/10.17226/29130>
6. Delta Science Program 2026. **Water Year 2024 and 2025 Winter-run Chinook Salmon Annual Loss Independent Peer Review.** <https://deltacouncil.ca.gov/delta-science-program/water-year-2024-and-2025-winter-run-chinook-salmon-annual-loss-independent-peer-review>
7. California Department of Water Resources. **California Data Exchange Center (CDEC).** <https://cdec.water.ca.gov/index.html>

Schedule

- Panel Review to commence in August 2026.
- Final Panel Report to be completed in October 2026.

Summary of Charge

Specific questions are identified below to guide the Panel for the review. Recommended review documents to focus on for each section of question are provided. The Panel is encouraged to review each question carefully and clarify, refine, or otherwise modify questions as appropriate. A map of the Delta is provided below for reference (Figure 1).

Review Questions

Spatiotemporal zone of influence related to entrainment and habitat conditions (Review Documents 1-5, 10)

1. Do the approaches assessing the spatial and temporal extent of export impacts described in the new lines of evidence provide a reasonable and useful representation of where and when near- and far-field export effects on listed fish species are most likely to occur?
 - a. Are the analyses accurate in terms of model structure, assumptions, covariate inclusion, and based on sufficient data?
2. Do the new lines of evidence capture listed fish survival and loss impacts associated with the zone of influence?
 - a. Are the analyses accurate in terms of model structure, assumptions, covariate inclusion, and based on sufficient data?
3. Is the weight of evidence sufficient for informing listed fish population and habitat responses to water export operations?
4. Are the references informing literature reviews thorough, relevant, and up to date? Are there more relevant or recent references that should be considered?

Population-level consequences of mortality due to Delta water exports (Review Documents 4-10)

5. Do the new lines of evidence advance the understanding of the potential proportion of listed fish populations that are impacted by water project export operations?
 - a. Are the analyses accurate in terms of model structure, assumptions, covariate inclusion, and sufficient data?
6. Are the identified consequences of these impacts to the populations (e.g. cohort replacement rate, abundance) adequately considered and based on best available science?

Addressing uncertainty and assessing improvements (Review Documents 1-10)

7. Compared with currently used LTO scientific basis (past lines of evidence; see supplemental documents 1 and 2), how do these lines of evidence improve understanding of exports on listed fish species and their habitats?
8. What are the limitations and uncertainties of the new lines of evidence, and were they appropriately addressed in conclusions?
9. Do you have additional insights or suggestions that could help identify the population-level impacts of export operations on listed species?



Figure 1: Map of the Sacramento-San Joaquin Delta (source: <https://water.ca.gov/Programs/Bay-Delta>)