Peer Review Summary Template

(9/26/2025)

Peer Review Plan

Rapid Structured Decision-making for Delta Smelt Summer-Fall Freshwater Outflow Management
[96 KB PDF]

Title and Authorship of Information Product to be Disseminated

Healy, B.D., Phillis, C.C., Mahardja, B., Koizumi, C., Pien, C., Parker, N., Conrad, J.L., Ekstrom, J., Leimbach, J., Silberblatt, R., Fischer, T., and Ehlo, C., 2025, Rapid structured decision making for *Hypomesus transpacificus* (delta smelt) during summer–fall freshwater outflow management.

Peer Reviewers Expertise and Credentials

Reviewer 1: The reviewer is a Research Ecologist at the U.S. Geological Survey, Columbia Environmental Research Center. He was an assistant and associate professor at Mississippi State University and taught courses in fisheries science, fisheries management, and natural resource decision-making. His research group applies decision-making approaches to conserving and managing aquatic resources. He joined the USGS in 2022.

Reviewer 2: The reviewer is Research Ecologist with the U.S. Geological Survey Idaho Cooperative Fish and Wildlife Research Unit. He currently works on fish and wildlife problems that emphasize modeling, including the use of Bayesian statistics, math, and numerical simulations. He works toward optimizing human decision-making around management objectives and measures of scientific evidence about the state of nature.

Reviewer 3: The reviewer is a Fish Biologist at the U.S. Geological Survey Southwest Biological Science Center. His research interests broadly span aquatic ecology including fish and invertebrates in both lakes and rivers. He examines coupled human-natural systems such as artificial and regulated river systems with a current focus on how drought, water storage, and reservoir operations impact biological invasions in the Colorado River Basin.

Charge Submitted to Peer Reviewers

The reviewers were asked to make an objective evaluation of the research, with emphasis on the methods, interpretation, and discussion of results.

Summary of Peer Reviewers Comments

Reviewer 1 made multiple comments to improve the text for clarity as well as for the definition of terms. He made several suggestions related to the need to define the temporal scope of the analysis and to clarify the predictive modeling approach and methods. He also suggested that further clarification was needed on how hypothesis weights were applied to competing baseline hydrology models and requested further clarification on an equation. The reviewer made suggested edits and clarifications on our use of multicriteria decision analysis tools and calculations, as well as the approach to weighting objectives and scaling the range of consequence scores for rankings of alternatives.

Reviewer 2 stated the document contains objective and insightful analysis, and the strengths of the decision-making process described in the document include:

- Rapid development of a useful decision-making framework about extremely complex and high-stakes management.
- Engagement with multiple stakeholders to define objectives and values.
- Use of advanced and tailored models to make quantitative predictions under different decisions.
- Quantitative and qualitative descriptions of the effects of uncertainty.

The reviewer also stated that the document was generally well written and executed. However, they offered the following recommendations:

- Clarify the tradeoffs among options/alternatives with respect to the objectives earlier in the document (in addition to minor editorial suggestions):
- Clarify the nature of the dynamics wherein an action affects a facilities' operation in future years. Simultaneously clarify that dynamics are not fully modeled here for the sake of expedience.
- Add a sentence or two clarifying why stakeholders:
    - Single-out some fish stocks and aggregate others.
    - Believe coldwater is a fundamental objective and not a means to preserving fish stocks.
    - Count water delivery twice along bureaucratic authorities (SWP, CVP) instead of the type of water consumer (municipality vs. agriculture).
- In the section titled Estimation of Consequences for Delta Smelt, consider whether a box and arrow diagram could clarify the inputs and outputs of the various coupled models.
- Soften and/or caveat language around the robustness of decisions with respect to a small reduction in the weight on Smelt or the weight on combined exports for Participant B and Reclamation.
- Add a few sentences to the final section titled Considerations for Future Decision Analysis that address how to improve participation by stakeholders in the MCDA weighting process. Ideally, the agencies would send participants with decision-making authority. Additionally, clarify whether/how agencies justify their weighting to one another in an open and respectful setting.
- Add a sentence to the final section titled Considerations for Future Decision Analysis that address one-way vs. multiple or global sensitivity analysis. Hint toward risk analysis as a framework for blending (continuous) probabilities of different system states with a (continuous) measure of utility.

Reviewer 3 commented that the report reads well, presents information and methods clearly, and is free of both grammatical and data related errors. He reviewed the scientific names presented in this report, found no errors, and suggested that the report was ready for publication and dissemination. He provided the authors with minor comments/suggestions, which mostly related to aesthetics or adding additional details.

Summary of USGS Response to Peer Reviewers Comments

All editorial suggestions from the three reviewers were addressed in the final draft of the report. Additional clarification on the temporal scope and details of predictive models was added, as well as more details on equation definitions, assignment of hypothesis and objective weights, and scaling of consequences.

The authors also added an additional sentence in the Ecological Context section to highlight the competing needs for water and added a specific example of tradeoffs (i.e., water for habitat needs for Delta Smelt and water quality might result in curtailment of water exports).

The authors added a few lines of text in the "Uncertainty and Value of Information" and Consequences section(s) to address the reviewers' concerns related to the clarity of our analysis of consequences of 2025 actions to the 2026 water supply. They also noted there is irreducible uncertainty in the 2026 hydrology that may constrain future storage. In addition, the primary

purpose of CalSim is to model the effects of water management operations over a multiple year period, which the authors think is an appropriate use of the model in this case (added short phrase and report citation for this). The authors also added a bit more to the ending paragraph (first sentence added), to address this comment: "Due to time constraints, we were unable to fully assess the effects of decisions made in this decision context to future decision-making. Dynamic programming may also allow for state-dependent decision making that considers effects to resources across years (Runge, 2020) and uncertainty in hydrology, which may be a better approach over the long-term than treating the decision as a one-off, given the dynamic nature of the hydrology and the need to manage for the risk of multi-year drought conditions."

Reviewer 2 raised important points about objectives included in the analysis. The authors added the following sentence in the objectives section to address the reviewer's comment: "Some objectives represented specific values participants placed on reservoir storage that would allow them to meet operational objectives for a single or multiple salmonid species."

Another comment by reviewer 2 refers to the coldwater pool and reservoir operational flexibility objectives for the State Water Project and Central Valley Project. These objectives were meant to capture the need for both water storage to benefit salmonids downstream of reservoirs (coldwater pool) and the need for reservoir operational flexibility for multiple other needs. The authors noted this wasn't clear and added additional text to table 1, and the objectives section to clarify the intent. The authors noted the participants involved placed particularly high values and have strong feelings about maintaining this reservoir operational flexibility, and despite the potential for double-counting, as displayed in the correlation analysis in the report, the authors opted to retain these objectives – they were considered fundamentally important to the participants.

Another comment by reviewer 2 relates to counting or quantification of water deliveries across bureaucratic authorities. There are two points to consider regarding this comment.
First, the two water projects (State Water Project, Central Valley Project), while coordinated, have separate decision makers and authorities (and end consumers of water deliveries), and separating them into 2 fundamental objectives was necessary for this analysis because there was not a single decision maker in this decision context. The decision analysis was also triggered by (federal) Executive Orders directed at the Central Valley Project (as noted in the introduction). Second, the authors were attempting to simplify the number of fundamental objectives to the minimum number necessary for a quality analysis for the decision makers (multiple in this case). Text was added in the objectives section to add this point about separate authorities.

The authors added a diagram showing the inputs, submodels, and outputs of the Delta Smelt model, now included as figure 3.

A caveat was added in the Summary and Discussion section to address the comment about objective weight sensitivity: "However, small adjustments in objective weights could have led to different rankings for Reclamation and participant B (see fig. 7)."

Reviewer 2 commented that the authors should address how to improve participation in the MCDA weighting process. While the authors agree that if agencies' or organizations' policy-makers participated in the decision analysis it might assist efforts in eliciting objective weights, the decision analyst authors are uncomfortable making recommendations to participants on which staff should participate in a decision analysis such as this one. The authors were not sure it is appropriate (particularly for USGS) to make this sort of recommendation. In addition, the authors note it was clear from one-on-one meetings with all parties that each had different motivations for participating (or not) in the objective weighting exercises. However, the following text was added to the swing weighting section: "..; regardless of whether participants were comfortable expressing their objective weights for final MCDA composite score calculations and alternative management action ranking, each was comfortable discussing their rationale for their objective rankings and weights in plenary."

The authors were unclear about the comment by reviewer 2 comment related to one-way vs global sensitivity analysis; however, the authors mentioned risk analysis as a framework that could be used for future decisions in the final sentence of the report (where there is a mention the potential use of dynamic programming).

The Dissemination

The published information product will be released as a USGS Open-File Report publication series and will be available at https://pubs.usgs.gov/.