CWF Phase 2b: Initial Panel Findings

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Overarching Comments (CS)

- Given the tight timeframe, the Panel appreciates the expanded analysis and detail between reviews Phase 2a and Phase 2b.
- Overall, most of the comments in our 2a PPT presentation were addressed to some degree.
- However, the Panel feel that we need to see “the big picture.”
  - Relationship of different elements
  - Sequence of different phases
  - Schedules and timelines (e.g. pre-construction studies, “up-front” mitigation)
  - Contingencies
  - Cumulative effects of PA at Delta-scale, including restoration actions
  - We recommend a “road map” (schematic) be provided.

Overarching Comments (CS)

- The Panel is not charged to evaluate ESA decisions. We are evaluating the adequacy of the analytical approach and the use of the best available science.
  - We generally approve the analytical methods that the services have used to evaluate effects.
  - The services have provided good evidence from best available science of significant adverse impacts to species and critical habitat.
  - However, details regarding how they will avoid, minimize, and mitigate that impact is not complete.
  - This underscores the need for a robust Adaptive Management process.

Overarching Comments (CS)

- The list of critical gaps and uncertainties should be prioritized.
  - In particular, information that would inform adaptive management triggers and thresholds should be prioritized.
    - For example, triggers for Delta Smelt and Longfin Smelt need to be identified.
  - Funding assurances are needed immediately for critical research needs.

Overarching objective: Identify to what extent the analyses for aquatic species in the draft BiOps on CWF are scientifically sound and defensible.

- Categories of questions:
  - Response to Phase 1 review comments
  - Best Available Information
  - Data Gaps and Uncertainties
  - Construction Considerations
  - Operational Effects
  - Longfin Smelt outflow criteria

1. How well does the analytical approach used in the NMFS BiOp respond to the panel's comments provided in Phase 1 of this review? Is the approach well applied in the determination of effects on individuals and the species? (CS/HG)

- Overall, major improvement.
- One of the Phase 1 review concerns was the failure to treat the Delta as a FW-Bay dynamic system. The Panel appreciates the improved conceptualization of critical habitat (and essential fish habitat), which (logically) expands analysis of PA effects on individuals and species to include entire Delta, considering both direct and indirect impacts.

1. How well does the AA in NMFS BiOp respond to Phase 1 comments? (cont.) (HG)

- **Uncertainty and Weights of Evidence issues (JVS)**
  - The analytical approach (AA) defines High/Medium/Low weights of evidence (p. 15).
  - It is unclear if these "weights" are equivalent to the High/Low/Medium "certainties" that are stated in Secs. 2.5.1.1 (construction) and 2.5.2.2 (upstream operations). (However, such certainties are not stated in 2.5.2.2, Delta operations).
  - If they are not equivalent, then what are the criteria for defining High/Medium/Low "certainty"? And how would these designations differentially influence the ultimate assessment of risk and exposure?
  - Also – The paragraph preceding Table 2.2 in the AA now mentions uncertainty, as the Panel suggested in Phase 1 review, but it is still unclear how "weights of evidence" and/or "certainty" designations (High/Medium/Low) will help determine the "not likely" (True/False) decisions in Tables 2.2 and 2.3. Suggest stating whether these determinations are to remain pure judgement calls.

1. How well does the AA in NMFS BiOp respond to Phase 1 comments? (cont.) (HG)

- **Adaptive Management**
  - The Analytical Approach (AA) recognizes important role of AM to reduce uncertainty around effectiveness of efforts to minimize impact on species and points to the “robust 100 page” AM Framework.
  - However, the Panel recently concluded that, while the Framework is a good starting point, much more work is needed before adaptive management can be successfully implemented to reduce critical uncertainties with regard to the PA.
  - Panel appreciates commitment to include monitoring for effects of climate change in AM and adjust planning in response to feedback from AM and real time operations.

1. How well does the AA in NMFS BiOp respond to Phase 1 comments? (cont.) (HG)

- **Links Between AM and Real Time Operations**
  - The Panel asked for better articulation of this relationship.
  - NMFS response is unclear: "Real-time operations and adaptive management will be designed to incorporate uncertainty and allow action within reasonable timeframes for those activities given opportunities or scenarios to address uncertainties."
- **Precautionary Principle**
  - Analytical Approach (AA) is explicit about adherence to precautionary principle, but does not provide details about how it might be implemented.
  - Given the combination of certainty about some negative effects and uncertainty about other potential effects, where does the precautionary principle fit in?

2. How well do the draft BiOps use best available scientific and commercial information?
(*Best Available Information*)

(2a) Do the status of the species and critical habitat and environmental baseline reflect the best available scientific and commercial information? (CS)

- Overall, species status, critical habitat and associated environmental baseline knowledge reflects the best available scientific information as well as acknowledging critical deficiencies.
- There are some issues of consistency, such as timing of adult spring Chinook and their vulnerability to pile driving effects.
- Information on life history diversity of salmon genetic stocks is somewhat buried, given its potential importance to population resilience; a comprehensive table describing spatial and temporal variation in life history traits (size frequency distribution, residence time, ecology, and survival) for each stock would help understand both their status and vulnerability to PA impact across the occurrence in the Action Area.

(2b) How well is the best available science used in the effects analysis and findings sections? (CS)

- Considering the limitations, particularly for the smelts, the best available science is appropriately utilized for the effects analysis and findings section.
- Effects on salmon, smelts and sturgeon were supported by comprehensive analyses, and new data and modeling were used in the BiOp in addition to earlier analyses. Incorporates more life history types.
- Some elements of effects analysis, such as mechanisms of acoustic stress and variable response in fishes, are complete.
- Many Avoidance and Minimization Measures (AMMs) appear to be well established and directly applicable, especially for construction effects.
- There are limitations of the modeled biophysical data. For example, in evaluating upstream effects, the use of monthly averages for both temperature and flow are too coarse (which is acknowledged). E.g., relating CALSIMII monthly flow to the stranding of juvenile salmon, which is a mechanism related to more rapid change in flow.

3. Do the draft BiOPs adequately address data gaps and uncertainties?
(*Data Gaps and Uncertainties*)

(3a) Are the assumptions in the effects analysis clearly stated and reasonable based on current scientific thinking? (EP/GR)

- It is acknowledged that flow-related operations will change before construction is complete, and thus the effects analyses based on the present operations will become obsolete.
  - Flow-related operations are under revision per the 2008 BiOp.
- Some assumptions used in the salmon effects analysis are missing. For example,
  - How might the use of surrogates bias findings? (e.g., representing other salmon ESUs with large, fall-run Chinook in migration and survival studies)
  - Survival analysis does not consider long-term PA effects on habitat or climate change beyond 2030.

(3b) How extensively are gaps in aquatic species life history information considered and appropriately addressed? (GR/EP)

- For salmon,
  - Five life history types were considered for winter Chinook, (although note the Panel's concern about using surrogates);
  - More discussion of impacts and uncertainty regarding small fry & fingerlings (30-70 mm or so) is needed.
- For Delta Smelt, impacts on (putative) spawning habitats are considered consistently throughout the FWS BiOp.

(3b) How extensively are gaps in aquatic species life history information considered and appropriately addressed? (CS)

- Given the difficulty of quantifying and tracking the amount of individuals at each life-history stage of each fish species, the use of the terms “small proportion”, “medium proportion”, or “large proportion” is appropriate.
- This allows cross comparison among stocks/ESUs with differing data completeness or quality.
- However, description of the variability in life-history stage composition, especially in juvenile migrant habitat use in riverine floodplains and across the Delta, is not complete.

(3c) How well are statistical uncertainties considered when assessing effects to individual survival (e.g., loss from predation, entrainment, impingement, etc.)? (JVS)

- Salmon BiOP includes recent statistical modeling by Perry et al. (2017), predicting through-Delta travel times, survival and migration routing of salmon smolts. Estimates of prediction uncertainty could be added to these analyses. Same comment applies to the interior Delta entrainment probability estimates and DSM2 discharge bias corrections of Perry et al. (USGS report)

(3c) How well are statistical uncertainties considered when assessing effects to individual survival…continued (NM)

The discrepancy between DSM2 flow and observations (Fig. 14,15) are clearly incorrect, and the Panel is not satisfied with the "tweak" that was made to get around the problem. One or two modeling parameters are not being switched correctly. Much more explanation is needed in this section of the USGS Open File report.

Evaluating the Effect of the North Delta Diversion on Flow Reversals and Entrainment of Juvenile Chinook Salmon into Georgiana Slough and the Delta Cross Channel

By Russell W. Perry, Jason G. Romine, Adam C. Pope, and Scott D. Evans

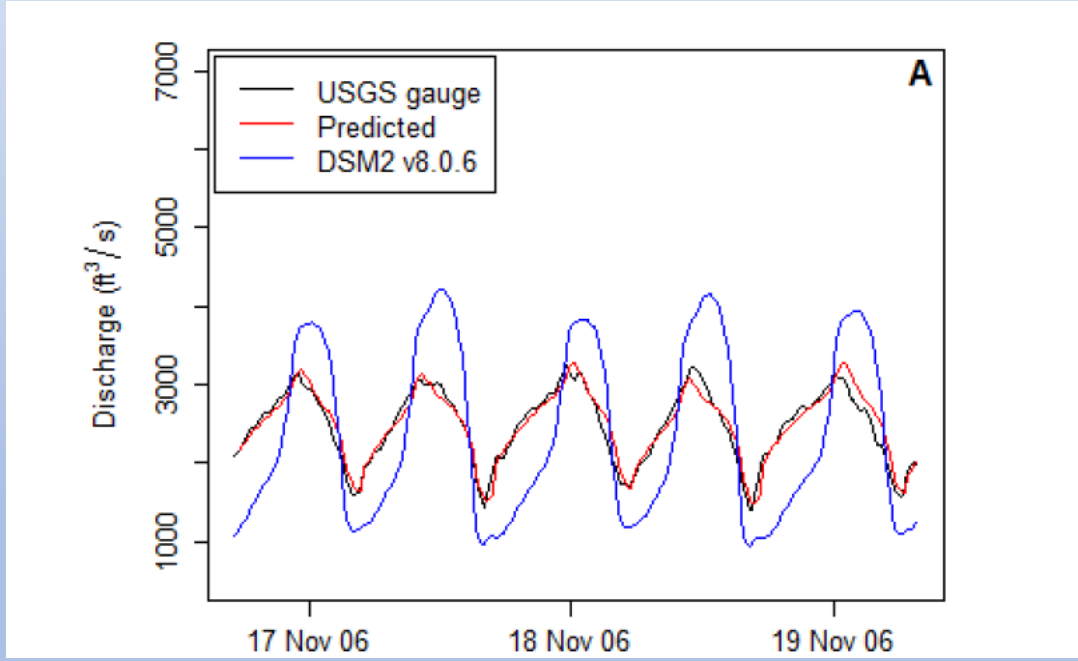


Figure 15. Comparison of observed, DSM2v8.0.6, and regression-corrected (predicted) discharge at the Sacramento River below Walnut Grove (WGB) USGS flow gage (A). Panel B compares observed and predicted discharge. The diagonal line has slope of 1 and an intercept of zero. Panel (C) illustrates the residuals of the predicted and observed discharge for WGB. 23

General Comments for Question 3 (*Data Gaps and Uncertainties*) (HG)

- Both BiOps rely heavily on AM to address data gaps and uncertainties.
  - E.g. NMFS AA says the AM program will address uncertainties associated with the effectiveness of management actions taken to avoid jeopardy and adverse modification of critical habitat "<u>and meet other regulatory standards</u> applicable to state listed species for: ongoing operations of the SWP/CVP, habitat restoration actions required for CWF and/or the CVP/SWP BiOps and CESA authorizations, and construction and operation of the CWF."
  - Examples are provided of the kinds of things the services will focus on and potentially adjust, <u>including water operations.</u>
- The Panel notes that a significant and overarching uncertainty is how robustly the AM plans as written will be implemented. Depends on decision making authority. Leaves much to discretion of IICG.
- Are NMFS and FWS relying on the robustness of the AM program in order to ensure future compliance with regulatory standards? Needs clarification.

4. Given the preliminary design specifications for the construction of CWF, how adequate are the analyses of effects for the various construction activities on the considered species in the draft BiOps? Consider the extended construction time frame.
(*Construction Considerations)*

(4a) Have the BiOps identified which construction-related effects pose a repeated and considerable effect to the species? (GR)

- FWS BiOp states (p. 217-218) that construction designs have not been finalized enough to allow evaluation of effects; FWS deferred to future consultations.
- NOAA BiOp identified many adverse impacts:
  1. Predation at barge landings—creation of predation hot-spots that will be in place for a decade.
  2. Large volumes of barge traffic (15,000 barge trips)
  3. Extensive pile driving at many construction sites (total number?)
  4. Cofferdam construction: Predation along very long cofferdam walls.
  5. Clifton Court Forebay: INCREASE in predation in this predation hot-spot.
  6. Chemical exposure in dredge materials & various construction activities: : will occur over a very broad area over an extended period of time (and not mitigated)
  7. Impacts on non-ESA fall and late fall Chinook salmon that are important prey of ESA-listed killer whale.
  8. Significant and repeated exposure of steelhead and adult fall Chinook to impact pile driving noise documented. Significant adverse impacts. Minimization measures (e.g., bubbles, vibration) likely to be insufficient.
  9. A quantitative summary of pile driving activities and impacts is needed.
  10. Clarify conflicting information presented in Section 2.4 and 2.5.1.1 regarding the timing of adult spring-run Chinook salmon exposed to pile driving. Describe the basis for the timing information.

(4b) Which construction-related effects will be most challenging to mitigate either by the methods proposed by the BA or other methods? (GR)

- Any factor that affects survival, especially over the long-term, will be difficult to mitigate.
  - Habitat restoration is good but difficult to empirically relate to survival/productivity.
- Habitat impacts: is 3:1 mitigation sufficient for ESA species?
  - Time to fully restore habitats may take years or decades, depending on system.
  - Need to develop plan and begin mitigation ASAP.
- No mitigation proposed for pile driving, impingement, contaminant re-suspension, physical injury, barge movement and sediment spill risk, predation associated with structures and operational effects on redistribution of salmonids in relation to salinity and fish distribution.
- Cofferdams at NDD construction sites will increase river velocity and block/impede upstream migration of spawning Delta Smelt
  - No options for mitigation proposed. FWS BiOp states that consultation will be re-initiated if the use of cofferdams is not feasible.
- Monitoring is needed to ensure that mitigation is adequately implemented and is having the expected benefit to the species.

(4b) Which construction-related effects will be most challenging to mitigate either by the methods proposed by the BA or other methods? (HG)

The AM framework will be an important tool for

- monitoring construction impacts in order to mitigate them
- monitoring effectiveness of mitigation performance

5. How adequately do the draft BiOps address the key operational effects of the proposed action? (*Operational effects*)

(5a) How well do the analyses provide sound information to adequately characterize the effects of north Delta diversion operations on outmigrating salmonids and sturgeon? (GR)

- Complexity of analyses by life stage in the BA and CWF ITP highlight the need for a comprehensive life cycle model.
- New NOAA life cycle model for winter Chinook salmon and associated survival analysis by Perry represent major improvements in the evaluation of PA effects on survival and life history diversity.
  - Incorporates five life histories and potential PA effects across the life cycle.
  - Expect model to evolve with new data and questions.
  - Use model to explore potential water diversion scenarios to reduce mortality and meet water demands.
  - Needs to discuss use of large hatchery late fall Chinook as surrogate for winter & spring Chinook, and steelhead.
  - Explain mechanism for greater PA effect on lower river smolts vs Delta smolts.
  - Clarify how model represents salmon >70 mm.
  - Conduct external peer review of model and subcomponents.
- Updated temperature analyses (Martin et al. 2016) incorporated into BO.

(5a) How well do the analyses provide sound information to adequately characterize the effects of north Delta diversion operations on outmigrating salmonids and sturgeon? (GR)

- BiOP needs to address operation effects on small juvenile salmonid (e.g., 30-70 mm), which are relatively abundant.
  - Fry and fingerlings may be most vulnerable because of their sensitivity to changes in shallow water, shoreline habitat, and possibly NDD diversion structures.
  - Less information available for fry and fingerlings, but see beach seine and trawl data.
- Models should evaluate PA effects on spatial structure and diversity of spring run Chinook salmon and steelhead.
- Critical habitat is generically described for salmon and sturgeon as freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, and estuarine areas. However, how different life history types utilize these different habitats needs to be described in detail.

(5a) How well do the analyses provide sound information to adequately characterize the effects of north Delta diversion operations on outmigrating salmonids and sturgeon? (NM)

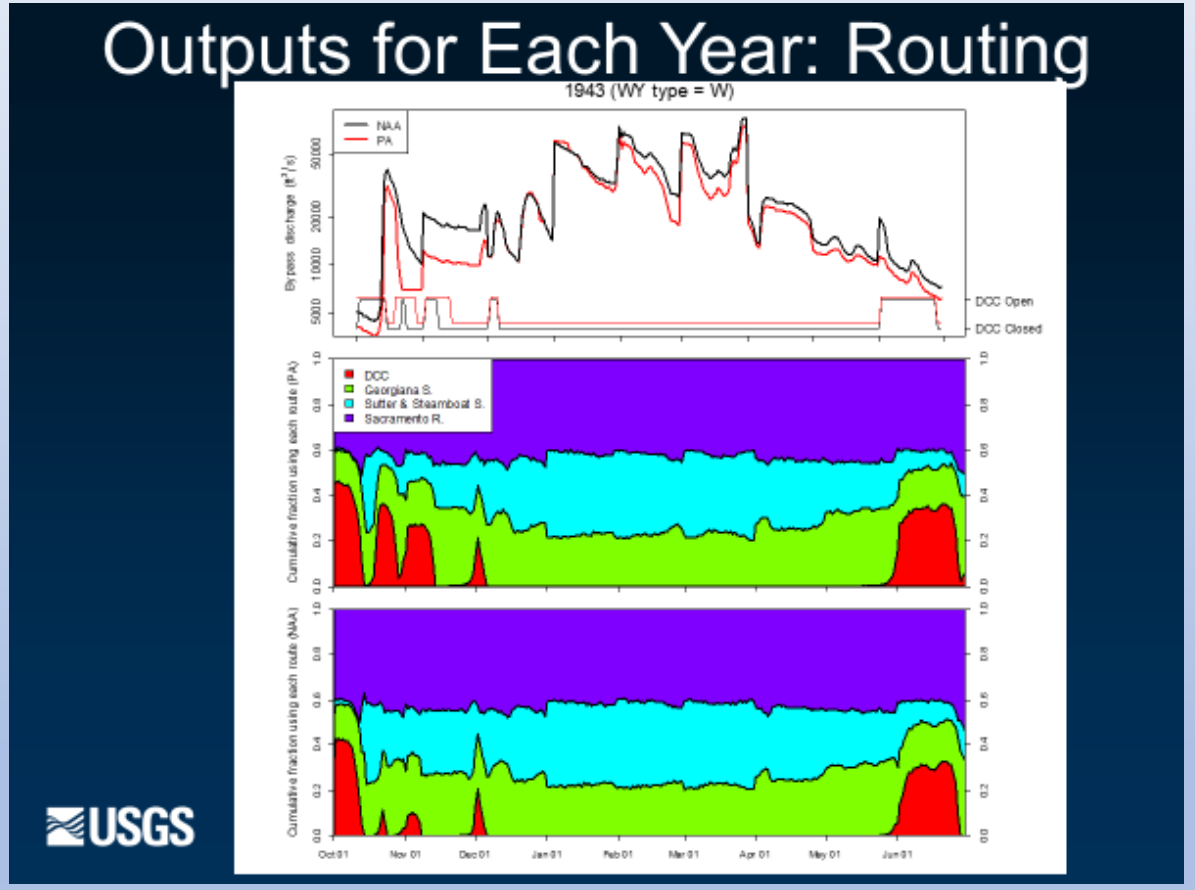
- Perry 2016 report:
  - Pg 24: "**It is generally understood that the diversion would be operated "in real time" to prevent reverse flows at Georgiana Slough….To our knowledge, such control rules have yet to be developed and evaluated using tools such as DSM2**."
    - Georgiana Slough/SAC/DCC is the transition zone for bi-directional flow in the Delta. This has been shown by field observations and numerical models. It is highly unlikely that "real time" operations can prevent reverse flows at Georgiana Slough.
    - This is a difficult location to model and to control in real-time.
    - Future restoration in the Delta will likely modify the transition location of uni-directional to bi-directional flow in this region.

(5a) How well do the analyses provide sound information to adequately characterize the effects of north Delta diversion operations on outmigrating salmonids…..? (NM)

Big picture question:

Will the Delta Cross Channel be operated in the same way as before? Should the criteria for closure take into account the flow above or below the NDD?

- Benefit of DCC open: lower salinity concentrations in the central Delta.
- Cost of DCC open: higher potential for diversion of fish into the Central Delta.



(5b) Do the analyses appropriately use novel techniques for assessing effects in the vicinity of the north Delta diversions? What improvements could be made to the developing methods to better inform management of the new infrastructure? (EP)

- Conducting both pre- and post-construction studies at the NDD (Tables 6.2-5 and 6.2-6 in FWS BiOp) is a robust approach.
  - Pre-construction studies will address sediment transport, tidal interaction with diversion rates, refugia from predation, and fish-screen hydraulic performance.
  - Monitoring-type studies of various duration (months to entire length of permit) will assess actual entrainment, impingement, and screen design/ performance.

(5c) How thoroughly do the data, analyses, and findings presented in the BiOps capture the risks to individuals and populations from the proposed actions? Are there significant risks that have been overlooked or other scientific information that should be considered? (EP)

- One substantial risk is that the AM program, which is the linchpin in accommodating uncertainty, might not have the capacity/authority to make adjustments as needed.

(5c) How thoroughly do the data, analyses, and findings presented in the BiOps capture the risks to individuals and populations from the proposed actions? Are there significant risks that have been overlooked or other scientific information that should be considered? (continued) (GR)

- Overall, the analyses were comprehensive and well-described.
- Adverse impacts on fish were identified during both construction and operation.
- The new NOAA life-cycle model for winter-run Chinook salmon, the associated survival analysis by Perry, and Martin's water temperature relationships represent major improvements to the evaluation of PA effects on salmon survival.
- The life-cycle model needs to be extended to other species while justifying the surrogate approach.

(5c) How thoroughly do the data, analyses, and findings presented in the BiOps capture the risks to individuals and populations from the proposed actions? Are there significant risks that have been overlooked or other scientific information that should be considered? (continued) (GR)

- The salmon analyses consider population-level impacts of a seemingly small absolute change in survival.
- The Critical Habitat Analysis should consider alteration caused by removal of water and complex interactions among salinity, vegetation, and other habitat features that support rearing salmon.
  - To what extent does NDD alter the distribution of salmon below NDD and access to quality habitat?

(5c) How thoroughly do the data, analyses, and findings presented in the BiOps capture the risks to individuals and populations from the proposed actions? Are there significant risks that have been overlooked or other scientific information that should be considered? (continued) (EP)

- Regarding Delta Smelt, the considerations presented in the FWS BiOp are comprehensive, but are largely dependent on interpretations of previous analyses, which appear sound.
- Population-level effects include the conclusion that very few adult Delta Smelt are expected to survive upstream passage by all three intake sites, resulting “in a contraction of the delta smelt’s historical range.” The FWS BiOp also acknowledges that this issue will be worsened by future salinity intrusions brought about by droughts or climate change (p. 201-204).

(5c) How thoroughly do the data, analyses, and findings presented in the BiOps capture the risks to individuals and populations from the proposed actions? Are there significant risks that have been overlooked or other scientific information that should be considered? (continued) (EP)

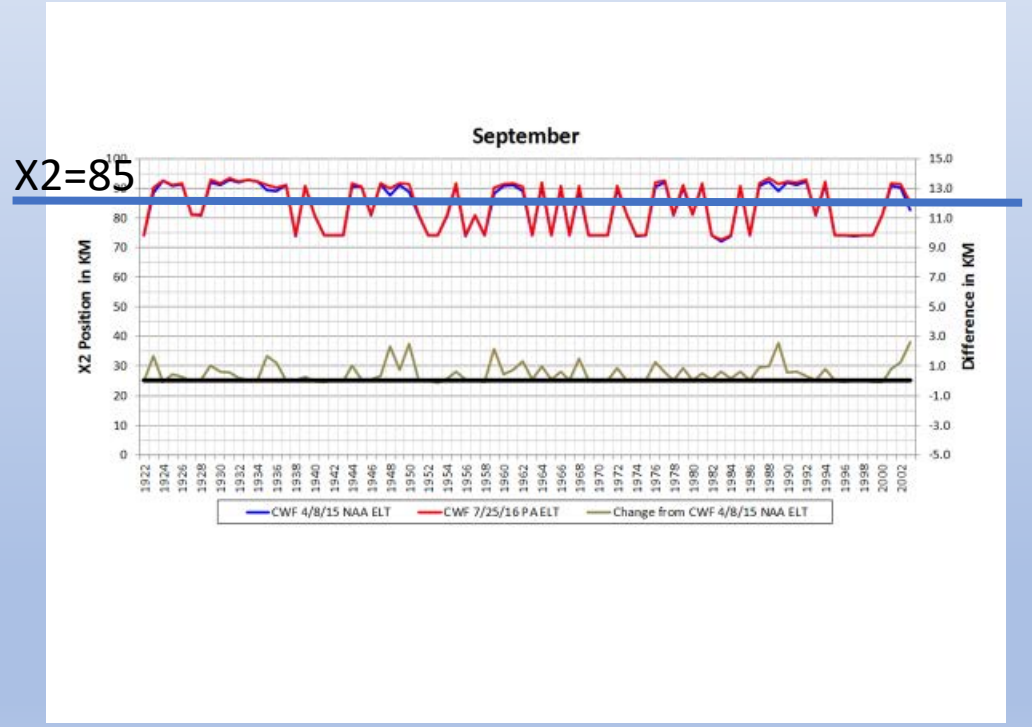
- Another primary conclusion, which is based largely on new analyses of X2 relationships with inflow, identifies repeated separations of Delta Smelt from their open-water rearing habitat during certain months.
- The stated risk to Delta Smelt is summarized as “the effects of the PA on critical habitat, and the current and future cumulative effects, will prevent the ability of delta smelt designated critical habitat to serve its intended conservation role for the species and will preclude the species’ recovery” (p. 282).

(5c) How thoroughly do the data, analyses, and findings presented in the BiOps capture the risks to individuals and populations from the proposed actions? Are there significant risks that have been overlooked or other scientific information that should be considered? (continued) (EP)

- Risks and benefits of NDD water withdrawal on essential fish habitat in the broader Delta does not appear to have been assessed. E.g., withdrawals, in combination with restoration, may affect water levels at shallow-water spawning and rearing habitats used by Delta and Longfin smelts.

(5c) How thoroughly do the data, analyses, and findings presented in the BiOps capture the risks to individuals and populations from the proposed actions? …(continued) (NM)

- Better explanation is needed regarding how X2 describes the interaction between the physical environment and biology.
- At X2 < 81 km, there is access to Honker Bay and other open-water habitats (longer residence times) rather than the engineered channels (shorter residence times).
- The cumulative months when X2 is > 81 km should be reported.



Source: CWF Delta Smelt Presentation slide: 77

(6) How clear is the proposed approach to establish Longfin Smelt outflow criteria for assuring spring outflow as modeled in the CESA permit application and presented as part of Phase 2A of the CWF Aquatic Science Peer Review?(NM) (*Longfin Smelt Outflow Criteria*)

- The underlying mechanism for the Longfin Smelt abundance:Delta Outflow relationship is a critical research topic.
- Spring Outflow criteria causes conflict between water supply and Longfin Smelt protection. (Public comment, Phase 2a)
- Development of minimum Delta outflow criteria for the spring period (February/March through May) that would be similar to what occurs under current authorizations for the CVP and SWP could help to minimize the effects of the CWF on Longfin smelt.

(6) How clear is the proposed approach to establish Longfin Smelt outflow criteria…. Continued (NM)

- The Panel found the presentation on modeling LS outflow criteria to be murky and disjointed. This presentation needs to be significantly improved before this concept is presented in other forums for review.
- The 8RI to Delta Outflow relationship was modeled as an exponentially increasing function of 8RI while the original presentation provided to the panel assumed a quadratic model structure.
  - The two model structures probably fit the data about equally well and make similar predictions.
  - Selecting a quadratic model structure represents underlying processes.
    - 8RI is proportional to the summed flows of the 8 rivers. And, Delta outflow must also be equal to those summed flows, plus or minus various withdrawals and additions due to irrigation, reservoir management, etc.
    - The argument for a linear, maybe plus quadratic, model would become stronger from the data pattern alone.
- The regression based on simulated outflows almost surely overstates the tightness of the relationship between actual future outflows and 8RI.