

Peer Review of the Fish and Aquatic Effects Analysis for the Long-Term Operations of the Central Valley Project and State Water Project

Summary and Highlights for the NAS Committee

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CENTER FOR ENVIRONMENTAL SCIENCE

Why?

- Overlap between NAS and Panel in some of the issues and models
- Panel reviewed Draft Effects Analysis
 - Methods only
 - Deep dive into the models and analyses
- Strengths and issues useful to NAS

Background to the Review

- Reinitiation of ESA Section 7 consultation
- Long-term Operations (LTO) of CVP and SWP
- Anticipated modifications to Proposed Action may impact
 - ESA-listed species
 - designated critical habitats
- Draft Effects Analysis (EIS) and directly informs BA

Background: Draft Effects Analysis

- Request from the BoR to the DSP
- Analysis mostly but not completely done
 - Excellent timing
 - Sufficient for a thorough review (caveats)
 - Partial analyses provided enough
 - Missing analyses were more challenging
- Focus of review is methods and not results
- Panel did not distinguish EIS and BA

DSP Review Panel

- Henriette Jager (Panel Chair), Quantus
- Nancy Monsen, Sole Proprietorship
- Zhoajun Bai, UC - Davis
- Emily Howe, Nature Conservancy



Draft Effects Analysis

- Background documents
- Review documents
 - Chapters for the BA
 - Appendices and attachments for the EIS
- Supplemental documents (~1000 pages)
- Total of 6,880 pages

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Peer Review of the Fish and Aquatic Effects Analysis for the Long-Term Operations of the Central Valley Project and State Water Project

A report to the Delta Science Program

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Delta
Science
Program

DELTA STEWARDSHIP COUNCIL

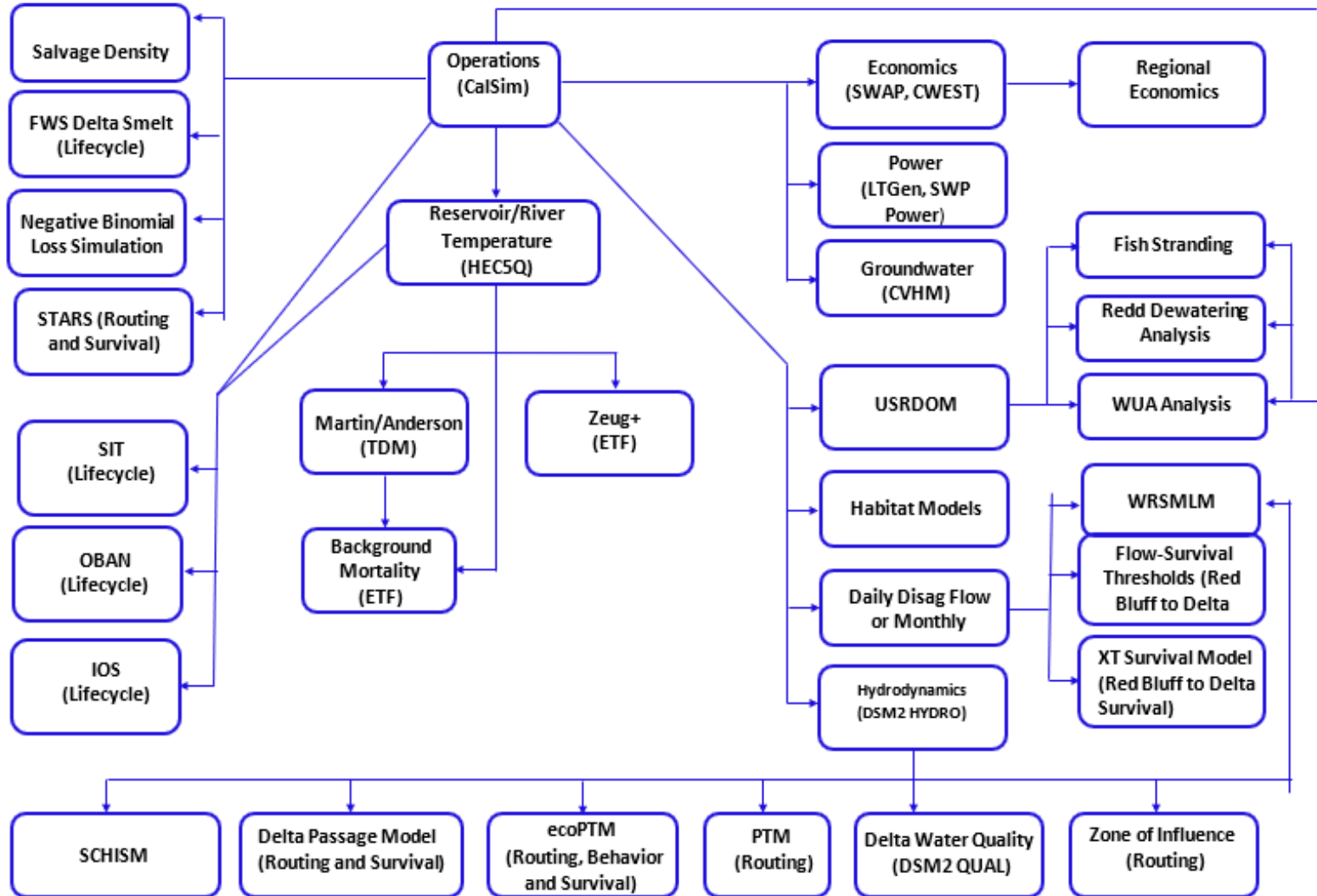
Type or Purpose	Sources used to evaluate models	Included	Previously reviewed
Numeric and Life Cycle Models	Appendix F Sections 1-3 and all Attachments related labeled 1-X and 2-X	Yes	No
	Appendix F Attachment 2-5 DSM2 Salinity	Yes	Yes
	Appendix F Attachment 2-11 HEC5Q	Yes	Yes
	Attachment F.3 CVPIA Winter-Run Life Cycle Model; Attachment F.2 CVPIA Winter and Spring-run Life Cycle Model	Yes	Yes, but updated
	Attachment F.4 CVPIA Spring-Run Life Cycle Model	Yes	Yes, but updated
	Attachment F.1 Maunder and Deriso in R Model	Yes	No
	Attachment F.5 Delta Life Cycle Model with Entrainment (LCME)	Yes	Yes

Old and Middle River	Attachment I.6 Volumetric Influence Analysis	Yes	No
	Attachment I.5 Survival, Travel Time, and Routing Simulation Model (STAR)	Yes	Yes
	Delta Passage model	No	Yes
	Particle tracking/fate modeling	No	No
	Eco-PTM	No	No
	Attachment I.3 Delta Export Zone of Influence Analysis	Yes	No
	Attachment I.1 Negative Binomial Salvage Model	Yes	No
	Attachment I.2 Old Middle River Salvage-Density Model Loss	Yes	No
	Winter run CWT proportional loss	No	Yes, but updated
	Attachment I.4 Longfin Smelt Salvage Old Middle River Relationship	Yes	Yes, but updated
	Flow into Junctions	No	Yes, but updated

Spring Delta Outflow	Attachment J.3 Zooplankton-Delta Outflow Analysis	Yes	No
	XT model	No	Yes
	Flow threshold salmon survival	No	Yes
	Appendix J.2 Sturgeon Year Class Index and Delta Outflow	Yes	No
	Appendix J.1 Longfin Smelt Outflow	Yes	No

Summer and Fall X2	SCHISM Habitat suitability modeling	No	Yes
Shasta Coldwater Pool	Winter run juvenile production index model	No	No
	Attachment O.3 Sacramento River Weighted Useable Area Analysis	Yes	No
	Sacramento Dewatering analysis	No	No
	Sacramento Juvenile stranding analysis	No	No
	Attachment L.1 Coldwater Pool Storage and Coldwater Pool Exceedance Analysis	Yes	No
	SacSalMort & Reclamation egg mortality modeling	No	Yes
	Attachment L.3 Egg-to-fry Survival and Temperature-Dependent Mortality	Yes	Yes, but updated
	Attachment L.2 Sacramento River Water Temperature Analysis	Yes	No

Folsom Flow and Temperature	Attachment M.3 American River Weighted Useable Area Analysis	Yes	No
	Attachment M.2 American River Water Temperature Analysis	Yes	No
	Attachment M.1 American River Redd Dewatering Analysis	Yes	No
	Attachment N.1 Stanislaus River Water Temperature Analysis	Yes	No
Stanislaus Stepped Release Plan	Appendix O- Tributary Habitat Restoration – only documentation for Stanislaus WUA	Yes	No
Tributary Habitat	Attachment O.2 Science Integration Team Life Cycle Model Habitat Estimates	Yes	No
	Attachment O.1 Coldwater Pool Clear Creek Weighted Useable Area Analysis	Yes	No



Not Reviewed

- Magnitude of effects
- Feasibility or scientific basis of alternatives
- Formulation of environmental baseline
- BoR's interpretation of the life cycle conceptual models

Caveats

- I am not representing the ISB
- Collective views of the Panel as in the report
- Some of the details and nuances lost due to time
- Final Q&A – may include my opinions

Review Process



- Meetings
 - Kick-off meeting with DSP & BoR
 - Panel throughout
- Each model analysis reviewed by 1-2 panelists
- Discussions led to:
 - Answering charge questions
 - Overarching/species comments
- Lead writer (me) captures the discussions and uses them with the reviews to develop a draft
- All reviewed, iterated, and edited report and approved it



The intent of the review is to evaluate the analytical approach taken by Reclamation to assess how the long-term operations (LTO) of the CVP and SWP affect the exposure, response, and risk to select ESA-listed species (individuals and populations).

The review will also assess whether quantitative and qualitative methods and risk assessment tools are used appropriately.

Charge #1: To what extent do the draft analyses **explain** the exposure, response, and risk from project operations (alternatives) for individuals, populations, and habitats for ESA species

- *Cover the major effects from the alternatives*
- *Not all are explicitly included and they are unevenly represented across species due to data and model limitations*
- *Better explanation of the role of the CMs*

Charge #2: To what extent do the draft analyses provide a **scientifically defensible approach** for evaluating effects on listed species and their critical habitats?

- *Coupled models, all informed from a common source (CALSIM-3), that included climate change as a solid foundation*
- *More integration of effects to population level*
- *Scales of coupled physical to ecological models*

Charge #3: How well do the draft analyses use the **best available scientific** information in their analyses and findings?

- *Existing models should have more confidence*
- *Most models have a history of model review*
- *Models must be evaluated for their appropriateness for each new question*
- *Maybe too much credence if the model was previously reviewed?*

Charge #4: How well do the draft analyses address **data gaps and uncertainties**? Are assumptions and methodologies suitable for addressing identified data

- *Reasonable methods for addressing data gaps were used with a few exceptions*
- *Interpolation of monthly from CALSIM-3*
- *Uncertainties (and certainties) was less well developed (feasible) than filling of data gaps.*
- *Inconsistent across analyses, no “big picture”*

Charge #5: Of the key operations modeled, how **adequate** are the models for representing the effects of the different alternatives on aquatic listed species and their habitat?

- *At a conceptual level, the models appear adequate to distinguish among alternatives.*
- *Model results by water-year type is helpful.*
- *Small differences among multiple alternatives*
- *Alternatives may differ in extremes not captured*
- *Climate change scenarios as a common driver?*

Global Comments

1. Impressive effort to date

- *Many datasets and coupling of models*
- *Solid conceptual basis (coupled, life history)*

2. Challenge of integration can/must be overcome

- *Organized by species – stopped at collation*
- *Go further in cumulative effects*
- *Implement weight-of-evidence*

Global Comments

3. BoR's philosophy on interpreting predictions is comparative analysis and reporting of model results (monthly)
 - *Panel disagreed on reporting monthly*
 - *Too coarse for some biological effects*
 - *Used monthly for daily is OK/wrong*
 - *Better interpolation should be investigated*

Overarching Comments (4-6)

4. Provide more presentation of uncertainty.
5. Clarify and standardize the baseline for comparison with alternatives.
6. Including climate change is a sound approach.

Overarching Comments (7-8)

7. Always use DSM2 and HEC-5Q salinity and temperatures, when appropriate.

8. Avoid averaging out effects.

- *Many alternatives generated same effects*
- *A few were consistently different*
- *Convergence from CALSIM-3 or Climate change?*

Overarching Comments (9-11)

9. Establish protocols for interpreting results.

- *Teams*

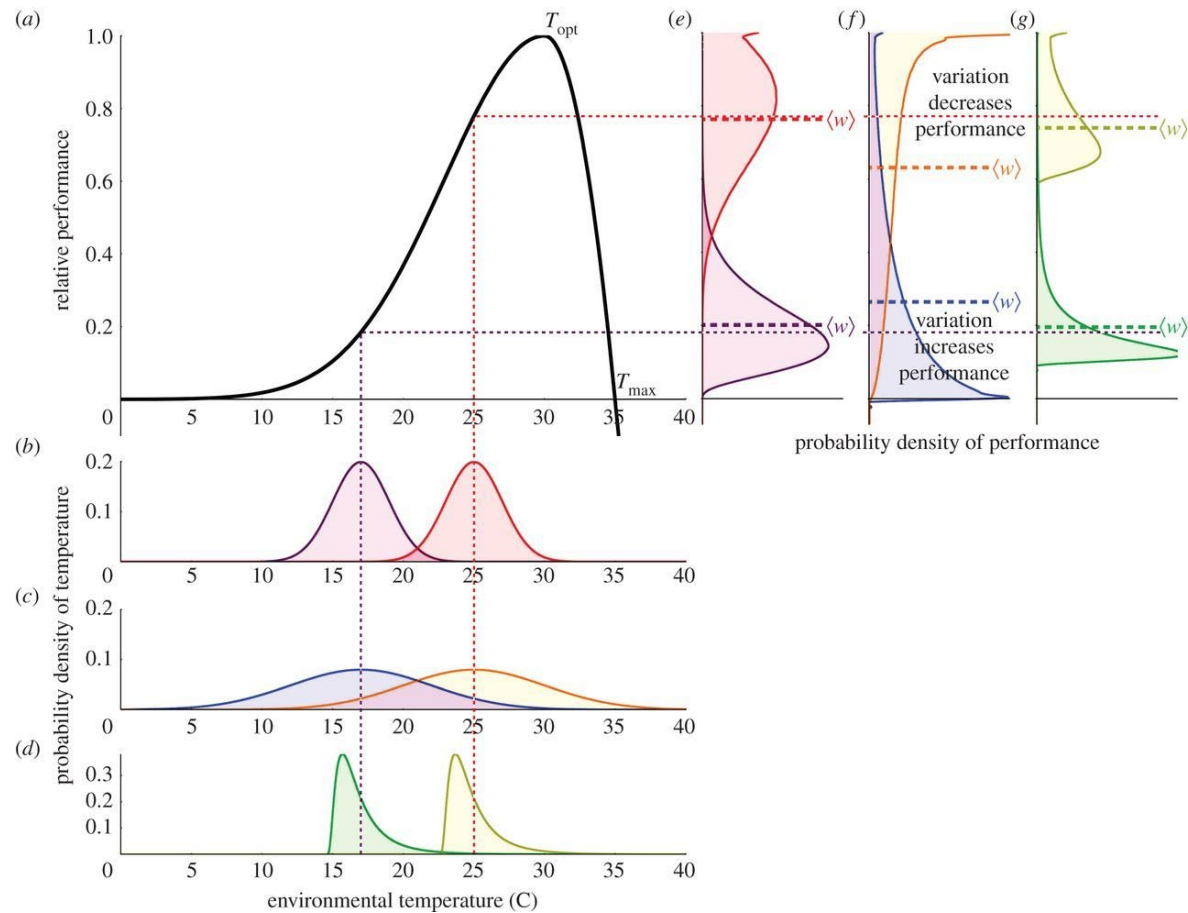
- *Integration team with raw outputs*

10. Consider species tradeoffs under alternatives.

11. Reconcile time/space scales in models.



Illustration (Not in Review)



Vasseur et al. 2014. Increased temperature variation poses a greater risk to species than climate warming.
Proc. Royal Society B, 281, p.20132612.

Overarching Comments (12-13)

12. Reconcile relevance of historical data used by models for “present-day” conditions.

13. Consider critical species’ responses to stressors (e.g., VSP) other than population.

- *Abundance* ✓
- *Population growth rate* ✓
- *Spatial structure*
- *Diversity*

Species Comments (14-15)

14. The method used to date in the species chapters for integrating effects is useful.

- *Categories: severity, proportion, frequency*

- *Appendices linked conceptual models, field data, and models to get proportion and frequency*



15. The analysis stops short of providing an integration of the stressor effects that limits understanding of population-level outcomes.

Species Comments (16-19)

- 16. Some components of the Effects Analysis destined for the BA should be better estimated.
- 17. Life cycle models are treated separately from the effects from other models.
- 18. There is no weight of evidence analysis presented.
- 19. Clarify how stressor effects were determined to be insignificant or discountable.

Species Comments (20-22)

- 20. Consider other related frameworks to improve and expand the approach.
- 21. Some of the studies cited seem outdated.
- 22. Graphical presentation of species-by-stressor effects is needed.

CASLIM-3, using multiple documents
Ch. 11 Killer Whale (zooplankton only)
Attachment O.1 Coldwater Pool Clear Creek Weighted Useable Area Analysis
Attachment O.2 Science Integration Team Life Cycle Model Habitat Estimates
Attachment F.2 CVPIA Winter and Spring-run Life Cycle Model
Attachment F.3 CVPIA Winter-Run Life Cycle Model
Appendix J.2 Sturgeon Year Class Index and Delta Outflow
Attachment F.5 Delta Life Cycle Model with Entrainment (LCME)
Appendix F - Attachment 2-5 DSM2 Salinity
Appendix F - Attachment 2-11 HEC5Q
Appendix J.1 Longfin Smelt Outflow
Attachment I.4 Longfin Smelt Salvage Old Middle River Relationship
Attachment F.5 Delta Life Cycle Model with Entrainment (LCME)
Attachment I.1 Negative Binomial Salvage Model

Attachment I.2 Old Middle River Salvage-Density Model Loss
Attachment I.5 Survival, Travel Time, and Routing Simulation Model (STAR)
Attachment O.3 Sacramento River Weighted Useable Area Analysis
Attachment M.3 American River Weighted Useable Area Analysis
Attachment L.1 Coldwater Pool Storage and Coldwater Pool Exceedance Analysis
Appendix K – Summer and Fall Delta Outflow and Habitat
Attachment L.3 Egg-to-fry Survival and Temperature-Dependent Mortality
Attachment M.2 American River Water Temperature Analysis
Attachment N.1 Stanislaus River Water Temperature Analysis
Attachment I.6 Volumetric Influence Analysis
Appendix O - Tributary Habitat Restoration (Stanislaus WUA)
Attachment I.3 Delta Export Zone of Influence Analysis
Appendix J - Attachment J – Zooplankton -Delta Outflow Analysis
Appendix M - Attachment M.1 American River Redd Dewatering Mortality
Climate change, including CALSIM-3

27 Individual Model Reviews

- Focus on OMR for examples
- Fall habitat
 - 2 other reviews ongoing
 - pieces
- Shasta and water temperature
 - I tried to present here
 - Complicated and incomplete
 - Needs a separate session
- Illustrate the reviews



Some General Comments

- CALSIM-3
 - Long-time issue of monthly output
 - Can add realistic daily/hourly and test
- Life cycle models
 - CVPIA Winter-run (+IOS, OBAN) and Spring-run
 - Delta smelt LCM and Maunder/Deriso in R
 - Wary of multiple models without a plan
- Climate change
- Hydrodynamic
 - Temperature and salinity
 - DSM2 (and SCHISM)

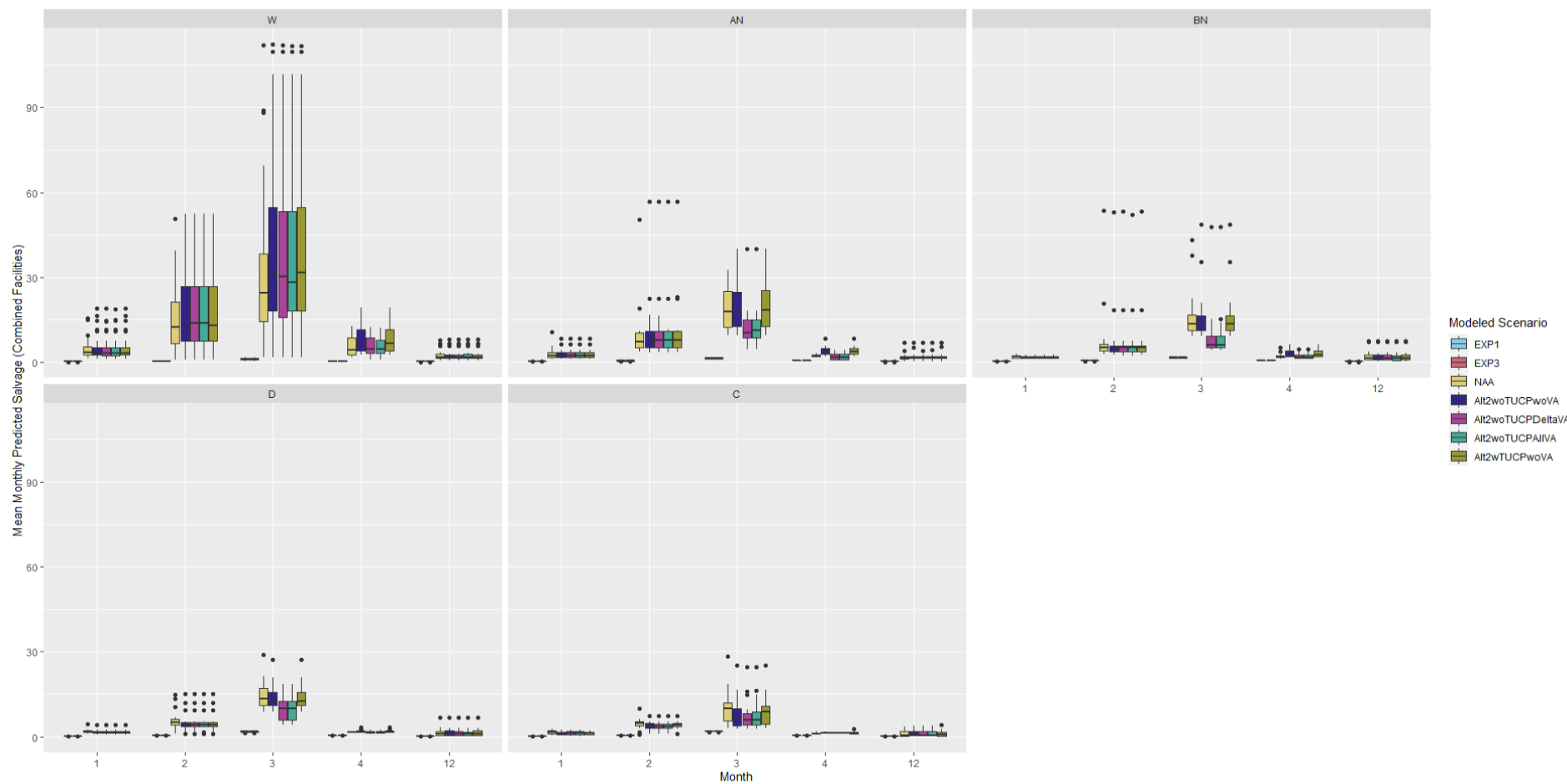


OMR: Negative Binomial Salvage Model

Table 2. Summary of model coefficients for Negative Binomial Monthly Winter-Run sized Chinook Salmon Salvage Model. The month of January was used as the reference categorical variable (i.e., intercept). The dispersion parameter was 1.38.

Model Variable	Estimated Coefficient	Standard Error
Intercept	0.27	0.27
Month – February	1.06	0.33
Month – March	2.25	0.34
Month – April	16.54	6.03
Month – December	-0.48	0.36
Sac Trawl CPUE	0.37	0.19
Export	1.03	0.12
San Joaquin Flow	-0.31	0.11
Month – February: Sac Trawl CPUE	0.18	0.28
Month – March: Sac Trawl CPUE	-0.88	0.34
Month – April: Sac Trawl CPUE	19.7	7.97
Month – December: Sac Trawl CPUE	0.01	0.26

Figure 1. Predicted average monthly salvage of winter-run Chinook salmon at the Delta fish collection facilities by water year type and month, based on the negative binomial salvage method. Note the y-axis scale is fixed. Figure displays data given in the preceding two data tables: Table 7, Table 8.



OMR: Negative Binomial Salvage Model

- Well done and statistically grounded
- Clever treatment of explanatory variables
- Good use of cross-validation
- Nice plots of results
- More synthesis (including across attachments)
- Graphical display of results and scaling



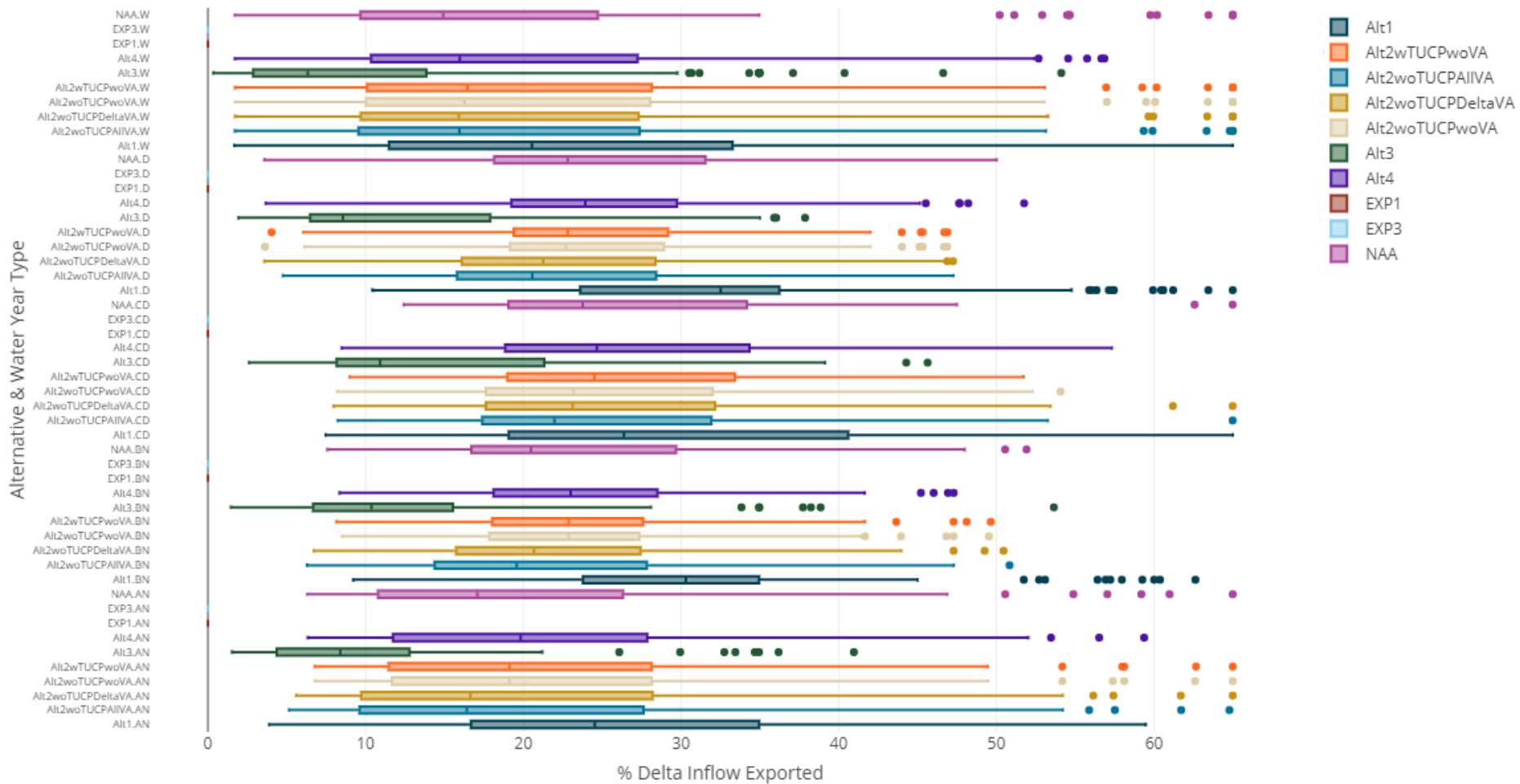
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OMR: Volumetric Influence Analysis

- CALSIM-3 monthly Delta inflow
- Sum CVP and SWP exports for the month
- December through June
- Compute % of Delta inflow diverted by exports

Distribution of % Exported grouped by Alternative and Water Year Type



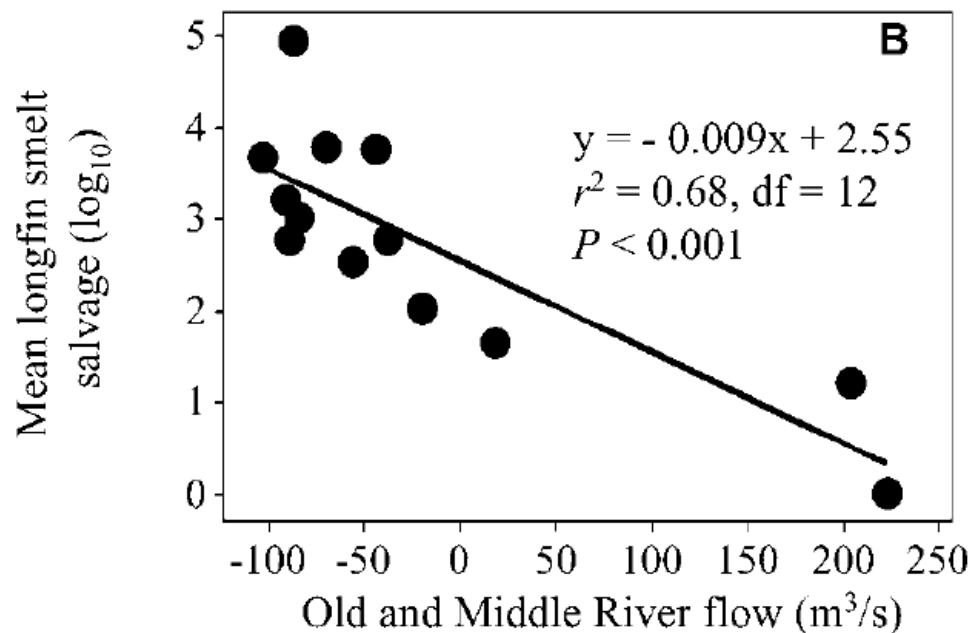
OMR: Volumetric Influence Analysis

- Possibly false that no differences among alternatives
- CALSIM-3 is the not model to use
- Delta is ~~≠~~ as a Continuously Stirred Mixed Reactor
- Other more-suited models are available
 - CALSIM-3 as boundary conditions
- Panel (strongly) suggests this be re-visited



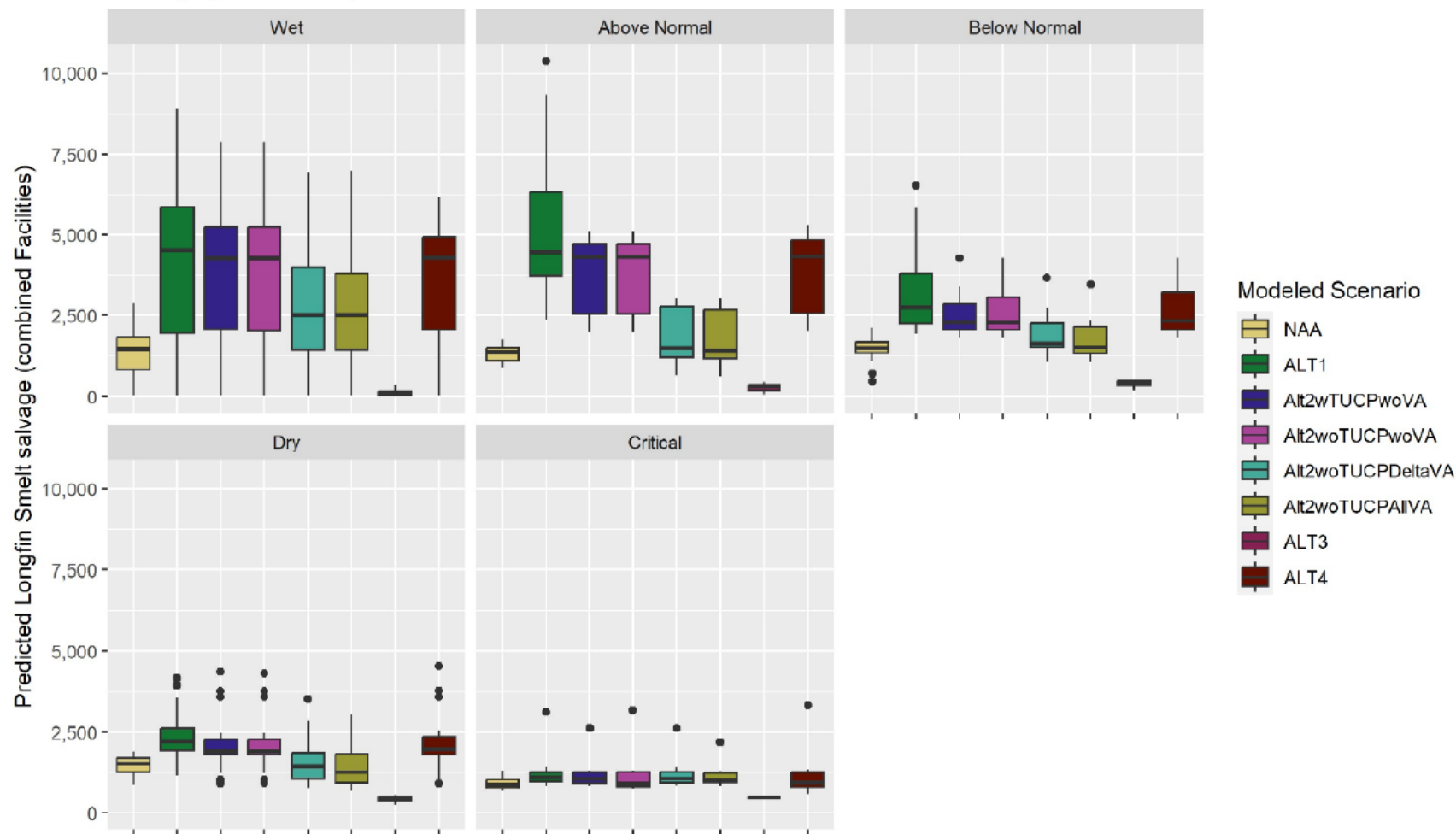
OMR: Longfin Smelt Salvage

- Use of a previous regression equation (2009)



OMR: Longfin Smelt Salvage

Salvage predicted by OMR flow



Annual Correlations

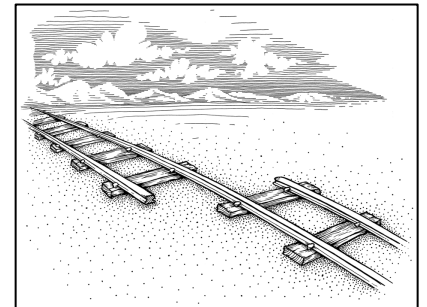
- Correlations using annual values have problems.
 - Many comments on zooplankton-outflow (Ch 9 –DS)
 - Unknown predictive power for new conditions
 - Often fall apart with new data
 - Influence points
 - Lack mechanistic understanding
 - Aggregated variables subject to spurious relationships
- Panel cautions use for comparing alternatives

Concluding Remarks

- Panel ***anticipates*** approach is scientifically sound
 - Incomplete draft was reviewed
 - Important caveats (if addressed, then)
- For example, several key models were questioned
 - Deserve further evaluation
 - Continued use in specific analyses
- Most models were considered usable, comments:
 - Representation of effects
 - Implementation
 - Calibration
 - Interpretation and Reporting

Concluding Remarks

- Using a common driver is good
 - Ways to deal with fine scale temporal variability
- Consistency across analyses/models
 - Benchmark time periods
 - Presentation of drivers and alternatives
 - Reporting
- Integration of results



Concluding Remarks

- BoR
 - Major effort
 - Much accomplished
 - Many comments, subset are critical
- Thanks to DSP staff, especially Aaron Angel
- Team effort by the Panel members
- Welcome to ask me questions