The Draft Report has no definition of the problem.

The Draft Report has no goal.
<table>
<thead>
<tr>
<th>“Problem”</th>
<th>Reduced flows and changes in natural flow regime impair fish and wildlife</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Problem is that SJB adult escapement is highly variable with a generally downward trend</td>
</tr>
<tr>
<td>“Conclusion”</td>
<td>Limiting factor [only one presented] is low survival at reduced flows since salmon and steelhead are &quot;adapted&quot; to natural flows</td>
</tr>
<tr>
<td></td>
<td>Unfamiliar with study suggesting that “the” limiting factor is related to “adaptation” to natural flows</td>
</tr>
</tbody>
</table>
It is worth noting that a restored flow regime does not need to track exactly the historic flow regime of the San Joaquin River because the behavior of both fall and spring run Chinook can be manipulated through selection to fit a regime that is practical using available water.
‘Re-establishment of some semblance of a natural system’
‘take action to protect’ salmon and steelhead
There’s Nothing Natural About the South Delta

Ecological Regime Shift Story

From river estuary ... to “weedy lake”

1873 → Today

“Review of Stressors on the Delta Ecosystem” Title of IEP Lead Scientist Talk to NRC 12/8/2010
Interagency Ecological Program 2010 Pelagic Organism Decline Work Plan and Synthesis of Results
Historic Floodplain Habitat Gone
Over 95% of Delta Leveed and Removed From Floodwater Inundation

Simenstad and Bollens 2003
Little is Done to Reverse this Trend and Create Native Fish Habitat
Variable Delta - A Hydrodynamic Perspective

Geometry, Geometry, Geometry

Jon Burau

USGS
Burau’s Historic Versus Current Habitat View

(1) Agricultural Reclamation

The geometry of the Sacramento/San Joaquin Delta has been incredibly manipulated by man.

Dendritic (tree like) geometry

Network of interconnected “loops”

These two systems have profoundly different transport characteristics

1873

2007

Slide from Jon Burau Presentation: Variable Delta - A Hydrodynamic Perspective
Homogenized and Connected Channels

Pre-settlement Delta:
- Tidal creek scale habitats with longitudinal physical/chemical gradients
- Tidal trapping at mouth
- No tidal pumping
- Exchange gradient is f(tide strength)
- Longitudinal temperature gradient
- Longitudinal productivity gradient
- Terrestrial connectivity and exchange

Slide from Jon Burau Presentation: Variable Delta - A Hydrodynamic Perspective
Most Common Delta Channel Shape

What do I mean by Geometry?

Horizontal Plan Form

Bathymetry
(bottom topography)

Slide from Jon Burau Presentation: Variable Delta - A Hydrodynamic Perspective
SWRCB “functions”
Water flows into the 13,000 acre floodplain through four levee breaches and exits the floodplain through one small breach.
Most water enters the bypass through Fremont Weir and flows 36 miles across 59,305 acres of cultivated and natural land.
San Joaquin River has No Equivalent Habitat
San Joaquin River Floodplain Model
In absence of floodplain connectivity, the functions attributed to higher ‘pulse flows’ cannot be achieved as described by the Flood Pulse Concept.

The flood pulse concept in river floodplain systems
Junk et al. 1989

The flood pulse concept: New aspects, approaches and applications – an update
Junk and Wantzen 2003
Velocity and Stage
Modeling indicates that increased San Joaquin River flows have little influence over velocities and stage in the South Delta downstream of the Head of Old River.

Instead, tidal influence and exports dominate flows in the South Delta downstream of the Head of Old River.

Effect of Increased Flow in the San Joaquin River on Stage, Velocity, and Water Fate, Water Years 1964 and 1988. Paulsen et al. 2008
Water temperature
Central Delta vs SJR Water Temperatures
SJR Vernalis Maximum Daily Water Temperatures

Exceedance of Maximum Daily Water Temperature at Vernalis
March 15 to June 15


6% of the time increase with respect to compliance

Temperature Criteria:
- SAN JOAQUIN VERNALIS BASELINE
- SAN JOAQUIN VERNALIS 60%
- 303(d) Temperature Criteria
Exceedance of Maximum Daily Water Temperature at Vernalis

September 1 to October 31


6% of the time decrease with respect to compliance
Water temperature, while easy to measure, is not a simple factor from both a physical and biological perspective. Thus single temperature standards (e.g., 18°C [64°F] is often given as maximum permissible temperature for salmon waters) are rarely very meaningful.

The ability of individual salmon to survive, tolerate, or thrive at a particular temperature is the result of a combination of recent thermal history (i.e., acclimation), availability of thermal refuges, length of exposure time, daily temperature fluctuations, genetic background, life stage, interactions with other individuals and species, food availability, and stress from other factors (e.g., pollution).
Contaminants

‘Dilution is not the solution to pollution’

Which contaminants?
Factors outside your control
The Delta is Now Dominated by Non-native Species

Non-native predators and competitors vastly outnumber native fish

Native fish rare

Feyrer and Healey 2003
All non-native predators deliberately introduced

- Striped Bass
- Crappie
- White Catfish
- Channel Catfish
- Largemouth
- Smallmouth
- Redeye Bass
- Spotted Bass

Moyle and Nichols 1974; Brown and Moyle 1993; Dill and Cordone 1997
The majority (69%) of California fish introductions were made by the California Fish and Game Commission and CDFG.
“Invasive species represent one of the most serious obstacles to preservation and restoration of listed native species.”

Delta Ecological Principals
Michael Healey 2007
Sub-adult Striped Bass with Chinook Smolts
Juvenile Striped Bass with Chinook Fry
What does NMFS think?

(1) Predation on winter-run Chinook salmon is a “major stressor” with very high importance

(2) Restoration for salmonids will require, among other actions, “significantly reducing the nonnative predatory fishes that inhabit the lower river reaches and Delta”

(3) Reducing abundance of striped bass and other non-native predators must be achieved to “prevent extinction or to prevent the species from declining irreversibly”

NMFS draft Recovery Plan for Central Valley salmon and steelhead

Hanson 2009; NMFS 2009
Elimination of striped bass fishing regulations would result in a **60-70% reduction** in the overall abundance of striped bass inhabiting the Bay-Delta.

Bennett 2009
“The NMFS has determined that poor ocean conditions are a major factor of the low 2008 SRFC [Sacramento River Fall Chinook] abundance. The NMFS also expects these poor conditions to continue affecting subsequent years’ SRFC escapements in the near future.”

California Fish and Game Commission Statement of Proposed Emergency Regulatory Action, 2008
Does the survival of SJR salmonids in the ocean affect returning adult abundance?
Does ocean survival vary annually?
“Boom and near-bust cycles”

SJB Fall-run Chinook Abundance 1952-2009
Over a restricted set of flows measured at Vernalis when the HORB was in place . . . a strong positive relation between estimated survival rates and Vernalis flow was evident.

Summary Report of The Vernalis Adaptive Management Plan (VAMP) for 2000-2008
San Joaquin River Technical Committee. 2008

There is no statistically-significant relation between estimated CWT survival rates and Vernalis flow . . . when the HORB has not been in place.

Summary Report of The Vernalis Adaptive Management Plan (VAMP) for 2000-2008
San Joaquin River Technical Committee. 2008
SWRCB in 1995 and 2006 WQCP recognized the value of the HORB and directed it to be installed and operated.
Outmigrating smolts that enter Old River have lower survival than fish that remain in the San Joaquin River. VAMP studies have shown only 2% of smolts that enter Old River make it through the Delta and most of those are fish salvaged at the pumps and trucked.

Without a fish barrier at HOR 67-78% of outmigrating Chinook become entrained in Old River.

Distribution and joint fish-tag survival of juvenile Chinook salmon migrating through the Sacramento-San Joaquin River Delta, 2008
Holbrook et al. 2009
If flow is so important to survival, why isn’t the relationship obvious?
More Flow = More Salmon

**Pre-1995**

\[ y = 2.2874x + 494.36 \]

\[ R^2 = 0.7373 \]

\[ P = 0.001 \]

**Post-1995**

\[ y = 2.0385x + 5027.7 \]

\[ R^2 = 0.7216 \]

\[ P = 0.001 \]
<table>
<thead>
<tr>
<th>Cited as Evidence in Draft Report</th>
<th>Baseline Data</th>
<th>Not appropriate for setting management goals because:</th>
<th>Peer-reviewed?</th>
</tr>
</thead>
<tbody>
<tr>
<td>DFG 2005</td>
<td>Escapement and spring flows at Vernalis</td>
<td>Peer review indicated the analysis and recommendations were FLAWED</td>
<td>Yes, rejected</td>
</tr>
<tr>
<td>AFRP 2005</td>
<td>Escapement and spring flows at Vernalis</td>
<td>Used simple linear regression to predict fish abundance from average spring flow at Vernalis—the same approach taken by DFG and rejected by peer review</td>
<td>No</td>
</tr>
<tr>
<td>TBI/NRDC 2010</td>
<td>Escapement and spring flows at Vernalis</td>
<td>Used a logistic model that only considered flow; predicted that flows of 10,000 cfs are “likely” to double salmon production but DID NOT provide any definition of &quot;likely&quot; or quantify uncertainty surrounding this estimate</td>
<td>No</td>
</tr>
<tr>
<td>Baker and Morhardt 2001</td>
<td>Escapement and spring flows at Vernalis</td>
<td>The relationship between flow and survival was “not well quantified,” and the lack of relationship between flow and escapement was likely due to other factors</td>
<td>Yes</td>
</tr>
</tbody>
</table>
### DFG Salmon Population Model History

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Substance</th>
</tr>
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</table>
| 1.0     | March 2005 | Intended to achieve the Narrative Salmon Doubling Goal. Peer Reviews were strongly negative:  
  • Ignored a logical positive relationship between spawners, juvenile production, and escapement;  
  • Non-flow factors could be just as important if not more important than flow (VAMP 2005 Report);  
  • HORB was rarely installed during the 1967-2000 period;  
  • Significant scatter in the relationship between striped bass and escapement, but no attempt to correlate the scatter plot;  
  • DFG omitted 1989 from the regression analysis because that year was an outlier, with a much higher smolt estimate compared to similar years. |
| 1.5     | August 2008 | Continued the empirical emphasis originating from model v1.0. Salmon Population Model was never provided for the public to examine.  
Again excluded year 1989. |
| 1.6     | May 2009  | Addressed some, but not all of, prior criticisms:  
  • No statistically significant difference between the regression lines with the HORB in and the HORB out;  
  • Added hatchery augmentation;  
  • Used historic tributary flow contribution to Vernalis flow to derive a relationship between tributary flow and Vernalis flow;  
  • The year 1989 as an outlier is not addressed. |
| 2.0     | TBD     | Is supposed to address peer review concerns regarding continued omission of factors such as exports, water temperature, early spring and fall flows, fry production, harvest rates, etc. |
Any success of CDFG’s plug and play model in predicting escapement is likely due to having previous year’s escapement as input!

- Each of the individual components' model suffers from *poor fits*: outliers, small coefficient of variation, small number of overly influential observations, non-robustness, non-linearity (after nonlinear transformation), poor Q-Q plots, etc.
- "Chaining" models *hides uncertainties at each level* and causes dependent errors
- Focusing on flow alone *ignores important sources of mortality* like ocean conditions, exports, predation, water temperature, etc.
(1) Weak relationship between flow and smolt production.

(2) Small number of overly influential observations with high flow levels inflating "upward" trend. Fit changes dramatically when these are removed.
Let’s review
The DFG, USFWS, and NOAA Fisheries, in coordination with the IEP and other interested parties, should **compile information and conduct specific studies** to determine whether and what changes should be made to the Spring Flow Objectives to protect SJR Chinook salmon and steelhead, pelagic organisms and other applicable fish and wildlife species. These entities also should **conduct analyses to determine whether it is appropriate to revise the methodology for determining when the higher spring flow objectives apply**, to better reflect hydrologic condition within the SJB. In addition, these entities should **conduct modeling to determine the water cost** of the various flow proposals and the sustainability of such proposals given the current water storage capacities and consumptive use needs within the SJB. These entities should **present any available information from such studies during the SWB’s workshop on the SJR flow issues.**
"It is undisputed that application of a quantitative life cycle model is the preferred scientific methodology. Based on the preponderating expert testimony, FWS had the time and ability to prepare the necessary life-cycle model. FWS made a conscious choice not to use expertise available within the agency to develop one. . . In light of uncontradicted expert testimony that life-cycle modeling is necessary and feasible, FWS's failure to do so is inexplicable."
“The San Joaquin River flow objectives are not changed in the 2006 Plan due to a lack of scientific information on which to base any changes.”
Recommendation

1. Develop life cycle model in an open, collaborative process as set forth in SWRCB 2006 Order.

2. If this Draft Report is sent for peer review, then send regression analysis/Fish & Game model as a separate component to be reviewed by statisticians.

   • Has a causal relationship between flow and escapement/survival been well established statistically?
   • Do the statistical analyses provide a reliable basis for setting flow policies to achieve quantitative goals
   • How large are the margins of error in predictions based on the statistical models?