Science and Management: The Vernalis Adaptive Management Program (VAMP)

Bruce Herbold USEPA
on behalf of the VAMP Technical Team
San Joaquin River flow at Vernalis
(cfs, average over ten days following smolt release)
VAMP

- 12 year study on delta survival
- 9 years done (2 flood outs)
- 5 experimental flow/export combinations
- Midwater trawl, Kodiak trawl and adult ocean captures supply data
Design Parameters

• Old River Barrier only at < 7000 cfs

• Smelt opinion requires:
  Exports < 0.5 Vernalis flow

• Minimal Exports = 1500 cfs
## VAMP Target conditions

### Flow at Vernalis (cfs)

<table>
<thead>
<tr>
<th>Exports (cfs)</th>
<th>3200</th>
<th>4450</th>
<th>5700</th>
<th>7000</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500</td>
<td>$A$</td>
<td>$B$</td>
<td>$C$</td>
<td></td>
</tr>
<tr>
<td>2250</td>
<td></td>
<td>$D$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3000</td>
<td></td>
<td></td>
<td>$E$</td>
<td></td>
</tr>
</tbody>
</table>
Selecting the Condition (1)

- Single Step  if base flow
- $< 3200 \rightarrow 3200$
- $< 4450 \rightarrow 4450$ etc.

- But…
Selecting the Condition (2)

- Critical = 1; Wet = 5
- Add current + last year
- If $> 7$, then **Double Step:**
  - $< 3200 \rightarrow 4750$
  - $< 4750 \rightarrow 5700$ etc.
- But…
Selecting the Condition (3)

- Critical = 1; Wet = 5
- Add current + last year
- If < 4, then **Offramp:**
  - No additional water required
  - 2008 critical so if 2009 not above average
- ...

Actual VAMP flows
San Joaquin River near Vernalis

- Excess Flow (Ramping)
- VAMP Supplemental Flow
- Other Supplemental Water
- Existing Flow (no VAMP)

Discharge (cfs)

Date


Target plus 7%
Target (4,450 cfs)
Target minus 7%

Pulse Period
Figure 2-4
2007 VAMP: San Joaquin River near Vernalis
With Lagged Contributions from Primary Sources

Target Flow Period
April 22 - May 22

Mean Daily Flow (cfs)

4/1/07 4/11/07 4/21/07 5/1/07 5/11/07 5/21/07 5/31/07 6/10/07

Stanislaus R below Goodwin Dam
Tuolumne R near LeGrange
San Joaquin R above Merced R
San Joaquin R near Vernalis

Ungaged Flow at Vernalis
### VAMP Conditions (so far)

<table>
<thead>
<tr>
<th>Exports</th>
<th>3200</th>
<th>4450</th>
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<th>7000</th>
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<td>2001</td>
<td></td>
<td>C</td>
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<td>2008</td>
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<td>3200</td>
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<td>E</td>
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<tr>
<td>Tag Code</td>
<td>Release Site</td>
<td>Release Date</td>
<td>Corrected or Effective Release number</td>
<td>First Day Recovered</td>
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<tr>
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<tr>
<td>06-47-13</td>
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<td>49,018</td>
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</table>
Conclusions

- Actual adaptive management
- Successful system level experiment
- No Barrier & few fish requires changes
- New technology offers new options