

# CHAPTER 7

## Conclusions & Recommendations

The VAMP experimental investigation of juvenile Chinook salmon survival was implemented during spring 2004. The Vernalis target flow was 3,200 cfs, with a combined SWP and CVP export rate of 1500 cfs. The HORB was successfully installed and maintained throughout the VAMP test period. Estimates of juvenile Chinook salmon smolt survival were calculated based upon releases of CWT juvenile salmon produced in the MRFF and released at Durham Ferry, Mossdale, and Jersey Point. Marked salmon were subsequently recaptured in sampling at the HORB, SWP and CVP export facility salvage, and through intensive fisheries sampling at Antioch and Chipps Island. Based upon the data and experience gained during the VAMP 2004 investigations, conclusions and recommendations have been developed, as summarized in Table 7-1. The conclusions and recommendations include both technical and policy/management issues that

will affect the design and implementation of VAMP 2005 operations and investigations.

Based on testing the relationship of salmon survival rates against flow and export conditions over the first five years it has been shown that survival generally improves as flows increase and flows relative to exports increase. With the addition of the 2003 and 2004 data, the relationships between salmon survival rates and Vernalis flows to SWP/CVP exports ratios are no longer statistically significant. Opportunities will be explored for variability in test conditions that are statistically robust and biologically valid in order to obtain fish survival data over a broader range of flow and export reductions. Survival testing at high flows and low exports (a high flow/export ratio) are important to obtain. The VAMP program provides improved protection for juvenile salmon when compared to “pre-VAMP” or without “VAMP” conditions.

**TABLE 7-1**  
*Summary of VAMP 2004 Conclusions and Recommendations*

CONCLUSIONS	RECOMMENDATIONS FOR 2005
Survival from Durham Ferry and Mossdale in 2003 and 2004 was significantly less than prior years. Further evaluation of survival rate versus flow and export rate is needed to detect differences in survival.	Survival tests at extreme target levels (e.g. 7,000 cfs flow and 1,500 cfs exports), or equivalent high flow/export ratios are necessary. The VAMP tests should be continued.
Flow measurements in the Old River and in the San Joaquin River downstream of the HORB were hampered by equipment malfunctions and calibration.	Maintenance and calibration of flow measurement equipment should be performed before the initiation of the 2005 VAMP and periodically checked throughout the VAMP period.
An accurate measurement of flow diverted through the HORB is essential to better understand the flow and entrainment relationship at the barrier.	Continue measurement of flow in at least one culvert as done in 2004 with desire to measure flow in all culverts.

CONCLUSIONS CONT.	RECOMMENDATIONS CONT.
<p>Mossdale Kodiak trawl is an important component in determining distribution of out migration from the San Joaquin Basin.</p>	<p>Maintain the Mossdale Kodiak trawl at existing or higher level of effort throughout year.</p>
<p>Observed ungaged flows (accretions, depletions) between upstream measurement points and Vernalis varied significantly from those forecasted resulting in differences between forecasted and required supplemental flows.</p> <p>Real-time streamflow data at San Joaquin River near Vernalis were improved by weekly verification of rating curves.</p>	<p>Hydrology committee to refine estimates of ungaged flow and develop a management scheme to accommodate variability.</p> <p>Continue weekly flow and calibration measurements. Investigate alternative flow measurement methods and/or locations.</p>
<p>Flow in the lower San Joaquin River downstream of Old River is important to evaluate the flow split at Old River and survival of salmon.</p>	<p>Calibrate the stage and flow monitoring system prior to and during the 2005 VAMP test period.</p>
<p>Coordination with upstream tributary operations was successful, though some imbalance against the Division Agreement resulted.</p>	<p>Continue coordination among tributary operators.</p>
<p>Operation of the HORB was successful in maintaining south delta water levels.</p>	<p>Continue to refine operational criteria for culverts, water level modeling, and groundwater level monitoring.</p>
<p>The use of fyke nets was successful in collecting entrained fish at the culverts.</p>	<p>Continue monitoring culverts using fyke nets to document fish entrapment.</p>
<p>The index of salmon entrainment at the HORB was significantly lower in 2004 (0.7 salmon per hour) compared to the past three years (3.4 in 2003; 2.5 in 2002; 1.4 in 2001).</p>	<p>Continue barrier monitoring and analysis of factors affecting entrainment.</p>
<p>Most salmon were entrained at night in 2004, similar to prior years. The relationship between tidal condition and salmon entrainment at HORB was variable.</p>	<p>Split releases at Mossdale should be re-instituted in 2005 to evaluate tidal-diel interactions affecting salmon entrainment.</p>
<p>2004 studies were successful in determining salmon entrainment at HORB culverts, but did not estimate mortality associated with HORB.</p>	<p>Evaluate methods to estimate mortality associated with HORB.</p>
<p>The release at Durham Ferry was improved by having the diversion pump at the site curtail operation.</p>	<p>Continue to curtail diversion pump operations during releases—coordinate release schedule with landowner.</p>
<p>Results of net pen studies showed a 0.8 percent mortality rate in 2004 compared to 0.5 percent in 2003.</p>	<p>Continue net pen studies and fish health inspections.</p>
<p>Physiological studies provided useful information on fish health and condition. Fish pathologists concluded that fish were relatively healthy and should have performed adequately for outmigration assessments.</p>	<p>Recommend continued health monitoring to compare within and between year trends of health and condition.</p>
<p>Blood chemistry analysis showed that all release groups were physiologically capable of handling stress associated with outmigration.</p>	<p>Baseline data for blood chemistry analyses should be taken from unstressed fish (not subjected to stress for 24 or more hours).</p>

CONTINUED ON NEXT PAGE

CONCLUSIONS CONT.	RECOMMENDATIONS CONT.
<p>2003 and 2004 survival rates were the lowest since the initiation of the VAMP and were significantly lower than those in 2002 under similar flow and export conditions.</p>	<p>Continue to evaluate differences in survival rates between release locations, flows, and export conditions.</p>
<p>Complimentary studies to evaluate mechanisms affecting survival of fish from tributaries and across the Delta were conducted.</p>	<p>Encourage an expansion of complementary studies to provide additional information on factors and mechanisms affecting salmon survival.</p>
<p>Few CWT salmon from VAMP releases were recovered at the SWP and CVP salvage facilities.</p>	<p>Continue salvage monitoring to document direct losses at SWP/CVP export facilities.</p>
<p>VAMP has been designed to adaptively manage experimental test conditions each year.</p>	<p>Continue to identify and evaluate opportunities to adaptively manage and refine the VAMP test conditions to improve protection for juvenile Chinook salmon out-migrating from the San Joaquin River, improve survival test conditions to detect differences in survival, if they exist, as a function of river flow and SWP/CVP export operations, and optimize the allocation of available water supplies each year.</p>

