

Executive Summary

Summary

The San Joaquin River Agreement (SJRA) and Vernalis Adaptive Management Plan (VAMP) is the cornerstone of a history-making commitment to implement the State Water Resources Control Board (SWRCB) 1995 Water Quality Control Plan (WQCP) for the lower San Joaquin River and the San Francisco Bay-Delta Estuary (Bay-Delta).  VAMP, officially initiated in 2000 as part of SWRCB Decision 1641, is a large-scale, long-term (12-year), experimental/management program designed to protect juvenile Chinook salmon migrating from the San Joaquin River through the Sacramento-San Joaquin Delta. VAMP is also a scientific experiment to determine how salmon survival rates change in response to alterations in San Joaquin River flows and State Water Project (SWP)/Central Valley Project (CVP) exports with the installation of the Head of Old River Barrier (HORB).

The VAMP experiment was modified in 2005 because high spring flows exceeded the upper target flow level of 7,000 cfs preventing the installation of the HORB. In addition, the SJRA technical committee recommended that the VAMP pulse flow period be moved from the default period of April 15 - May 15 to May 1 - May 31, when flows were anticipated to be more stable over the 31-day period. A continued wet hydrologic condition resulted in flood control releases on both the Tuolumne and Merced rivers; and excess water released from the Friant Dam on the Upper San Joaquin River. These conditions resulted in a gradual increase in Vernalis flow between May 1 and May 31.

The 2005 Annual Technical Report consolidates the annual SJRA Operations and the Vernalis Adaptive Management Plan (VAMP) Monitoring Reports. The VAMP 2005 program



represents the sixth year of formal compliance with SWRCB Decision 1641 (D-1641) . D-1641 requires the preparation of an annual report documenting the implementation and results of the VAMP program. Specifically, this 2005 report includes the following information on the implementation of the SJRA: the hydrologic chronicle; management of the additional SJRA water; flow and fisheries monitoring in Old River; results of the juvenile Chinook salmon smolt survival investigations; discussion of complementary investigations; and conclusions and recommendations.

VAMP employs an adaptive management strategy to use current knowledge to protect Chinook salmon as they migrate through the Delta, while gathering information to allow more efficient protection in the future. In addition to providing improved protection for juvenile Chinook salmon emigrating from the San Joaquin River system, specific experimental objectives of VAMP 2005 included:

- Quantification of Chinook salmon smolt survival between Durham Ferry, Dos Reis, and Jersey Point using recapture locations at Antioch and Chipps Island, under conditions of a San Joaquin River flow at Vernalis above 7,000 cfs, without an installed HORB, and SWP/CVP export rates of 2,250 cfs.
- Evaluation of the San Joaquin River – Old River flow split at the Head of Old River under the 2005 flow conditions without the installed HORB.
- Monitoring in Old River to evaluate the movement of salmon smolts into the Old River under the 2005 flow conditions without the installed HORB.
- Health and physiology testing of VAMP fish over an extended period to evaluate disease, swimming performance, and saltwater adaptation.

VAMP provides for a 31-day pulse flow (target flow) in the San Joaquin River at the Vernalis gage along with a corresponding reduction in SWP/CVP exports. The magnitude of the pulse flow is based on an estimated flow that would occur during the pulse period absent the VAMP. As part of the implementation planning, the VAMP hydrology and biology groups meet regularly throughout the year to review current and projected information on

hydrologic conditions occurring within the San Joaquin River watershed. This facilitates communication and coordination for both the VAMP Chinook salmon smolt survival experiments and for scheduling streamflow releases on the Tuolumne, Merced, and Stanislaus rivers to facilitate these experimental investigations and protection for juvenile salmon within the tributaries.

In planning for the VAMP, the March 23 operation plan forecasted an existing a flow of about 6,665 cfs, thereby calling for a VAMP target flow of 7,000 cfs. This early forecast also indicated that the HORB could not safely be installed during 2005 due to flows exceeding 5,000 cfs in the San Joaquin River during the installation period. As wet conditions continued through the spring period, operators for New Don Pedro on the Tuolumne River and Lake McClure on the Merced River were required to initiate flood control operations. Due to continued wet conditions and the forecasted flood control operations on the Tuolumne and Merced rivers the subsequent operations plans forecasted an existing flow at Vernalis in excess of 7,000 cfs. The SJRA Technical Committee recommended delaying the start of the VAMP pulse period from April 15 to May 1 in an effort to provide for increased stability of Vernalis flows. Additionally, the SJRA Technical Committee modified the experimental design to measure survival between Durham Ferry and Dos Reis and Jersey Point without a HORB.

VAMP experimental test conditions that have occurred over the past six years are summarized below:

Year	VAMP Period	Average Vernalis Flow (cfs)	Average SWP/CVP Exports (cfs)
2000	April 15-May 15	5,869	2,155
2001	April 20-May 20	4,220	1,420
2002	April 15-May 15	3,300	1,430
2003	April 15-May 15	3,235	1,446
2004	April 15-May 15	3,155	1,331
2005 ^a	May 1 –May 31	10,390	2,986

^a HORB not installed.



Water temperature data were collected with a series of computerized recorders at the Merced River Fish Facility, in the transport trucks, and throughout the lower San Joaquin River and Delta. Overall the average temperature at all sites ranged from 19 to 22 C.

Kodiak trawling was conducted in Old River in 2005, in addition to the usual sampling conducted in the San Joaquin River near Mossdale. Data from the two sites were compared to assess movement into the Old River during the VAMP period when there is no HORB installed. The ratio between the number of unmarked salmon and CWT salmon captured at the two locations was similar. A daily average,

over a 19 day period, of about 55 percent of the unmarked salmon and 64 percent of the CWT salmon migrated down the Old River. This estimate assumed efficiency of the two trawls was similar. We were not able to determine the relative efficiency between gears at the two locations so the true percentage of fish migrating into each channel is unknown.

Consistent with the VAMP experimental design, the 2005 effort included two mark-recapture studies performed in early May to provide estimates of salmon survival under similar flow and export conditions. The experimental design in past years included multiple release locations



at Durham Ferry, Mossdale, and Jersey Point. In 2005, the releases were made at Dos Reis instead of Mossdale to better assess losses into upper Old River. The multiple recapture locations (Antioch, Chipps Island, SWP and CVP salvage operations, and in the ocean fisheries) were the same in 2005 as they have been in past years. The use of data from multiple release and recapture locations allows for a more thorough evaluation of juvenile Chinook salmon smolt survival as compared to recapture data from only one sampling location and/or one series of releases.

Chinook salmon smolt survival indices were calculated based on the numbers of marked salmon released and the number recaptured. Releases at Jersey Point serve as controls for releases at Durham Ferry and Dos Reis. Recapture data from Antioch, Chipps Island and in the ocean fishery thereby allowed calculation of survival estimates based on the ratio of recovery rates or survival indices from marked salmon recaptured from upstream (Durham Ferry and Mossdale/Dos Reis) and downstream

(Jersey Point) releases. Use of ratio estimates as part of the VAMP study design factors out the potential differential gear efficiency at Antioch and Chipps Island within and among years. It also factors out ocean survival when using the ocean recovery data. These ratio estimates were used to evaluate relationships between salmon smolt survival and San Joaquin River flow and CVP and SWP exports with and without the HORB in place.

The estimated survival of coded wire tagged (CWT) salmon released from Durham Ferry and Dos Reis was the third lowest measured since 2000. Samples of CWT salmon from the 2005 VAMP lots were collected and taken to the California-Nevada (CA-NV) Fish Health Center prior to the release dates for rearing and monitoring over an extended period. At the actual time of release the test fish appeared relatively healthy based on results of short-term survival studies and physiological examinations and should have performed adequately for outmigration assessment. However, 27 percent of the test fish held at the Fish

Health Center died due to Proliferative Kidney Disease (PKD) between 36 and 50 days after collection, indicating that survival may have been reduced from the effects of PKD after the fish passed Chipps Island. This reduction would not be reflected in the recapture data from Antioch and Chipps Island, but may be detected in future ocean recovery rates.

In 2005, the HORB was not installed and could have contributed to the low survival observed. Past evaluations have indicated that survival for salmon migrating through the Delta is lower when there is no HORB installed.

Survival through the Delta does appear to be related to San Joaquin River flow at Vernalis, especially with the HORB in place. Relationships observed when there was no HORB in place are more variable and not statistically significant, although both the ocean and trawl data show a similar trend of increased survival with increased flows.

The relationship of survival to exports is still difficult to detect based on the data gathered to date. The escapement data for adult salmon indicate that the flow/export ratio explains more of the variability in adult escapement than flow alone, but the smolt survival data is too limited to detect these effects, if they are real. To further refine the relationship between survival and flow or flow/export ratio, the survival experiments need to be conducted at a flow of 7,000 cfs with HORB installed at the two export levels, 1,500 and 3,000 cfs. We have not yet met these experimental conditions.

Conducting experiments when there is no HORB will further define and refine the relationship of survival to exports and flow.

In addition to this recommendation, each previous technical report contained recommendations for future VAMP implementation. Key conclusions and recommendations resulting from the 2005 VAMP include:

- Survival from Durham Ferry and Mossdale/Dos Reis in 2003, 2004, and 2005, was significantly less than prior years. Continued evaluation of survival rate versus flow and export rate is needed to detect differences in survival tests at extreme target levels (e.g. 7,000 cfs flow and 3,000 or 1,500 cfs exports), or equivalent high flow/export ratios are necessary.

- The flow data collected in 2005 at San Joaquin River near Lathrop and the Head of Old River provided a useful evaluation of the flow split at the Head of Old River. Comparison of these 2005 flow data against DWR-DSM2 modeling results should be conducted and may provide useful information.

- The Clifton Court Forebay was treated with the aquatic herbicide Komeen, known to be toxic to salmon, one day following the Durham Ferry release of test fish. DWR and USBR should coordinate operation and maintenance activities at the SWP and CVP export facilities with the VAMP technical groups.

- VAMP 2005 was the first time a sample of experimental fish were held at the CA-NV Fish Health Center for health evaluation, swimming performance testing, and saltwater adaptation testing. Such testing and evaluation should be continued in future years.

- The numbers of CWT salmon, from Durham Ferry releases recovered at the SWP and CVP salvage facilities were greater than prior years due to the lack of a HORB. Only a few Dos Reis fish were recovered at the SWP and CVP salvage facilities.

- VAMP has been designed to evaluate opportunities to adaptively refine the VAMP test implementation conditions to: improve protection for juvenile Chinook salmon migrating from the San Joaquin River, and to improve the ability 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.

The VAMP program should continue until smolt survival has been examined in relation to all target flow and export rates with an installed HORB. When completed the VAMP study should demonstrate the value of large-scale, long-duration, interdisciplinary experimental investigations that provide both protection to fishery resources while also providing important information that can be used to evaluate the performance and biological benefits of various management actions.