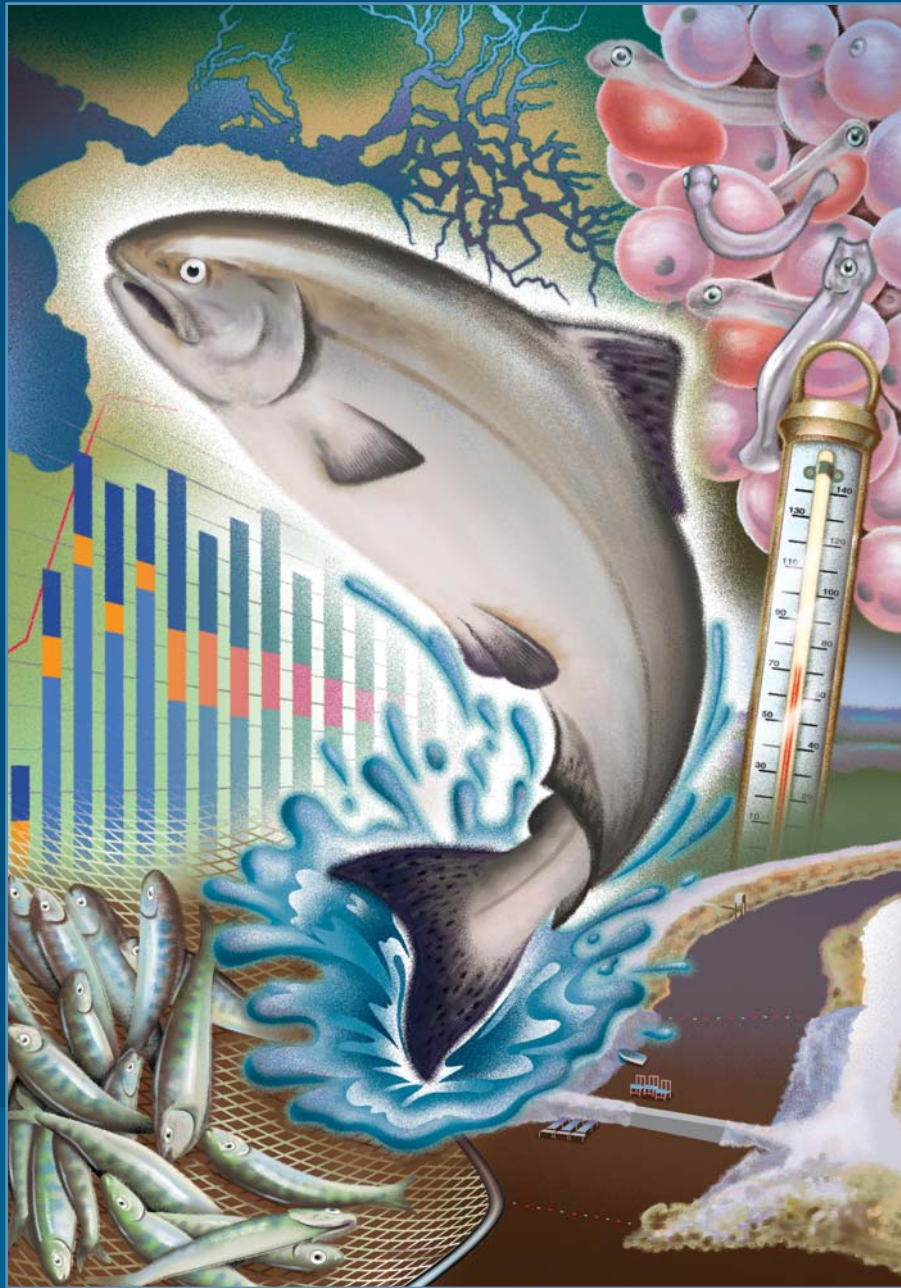


2002 ANNUAL TECHNICAL REPORT



SAN JOAQUIN RIVER GROUP AUTHORITY



Head of Old River Barrier

2002 ANNUAL TECHNICAL REPORT

On Implementation and Monitoring of the San Joaquin River
Agreement and the Vernalis Adaptive Management Plan

Prepared by

SAN JOAQUIN RIVER GROUP AUTHORITY

Prepared for the


CALIFORNIA

STATE WATER RESOURCES CONTROL BOARD


In Compliance with D-1641

JANUARY 2003

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EXECUTIVE SUMMARY

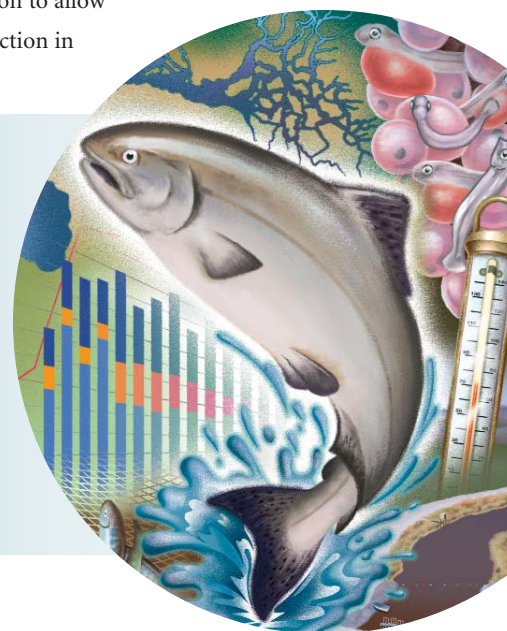
The San Joaquin River Agreement (SJRA) is the cornerstone of a history-making commitment to implement the State Water Resources Control Board (SWRCB) 1995 Water Quality Control Plan (WQCP) for the lower San Joaquin River and the San Francisco Bay-Delta Estuary (Bay-Delta). Using a consensus-based approach, the SJRA united a large and diverse group of agricultural, urban, environmental and governmental interests. 


The 2002 Annual Technical Report comprises the consolidated annual SJRA Operations Report and Vernalis Adaptive Management Plan (VAMP) Monitoring Report. The VAMP 2002 program represents the third year of formal compliance with SWRCB Decision 1641 (D-1641). D-1641 requires the preparation of an annual

A key part of this landmark agreement is the VAMP. VAMP is designed to protect juvenile Chinook salmon migrating from the San Joaquin River through the Sacramento-San Joaquin Delta. VAMP is also a scientifically recognized 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 and the installation of the HORB.

VAMP employs an adaptive management strategy to use current knowledge of hydrology and environmental conditions to protect Chinook salmon smolt passage, while gathering information to allow more efficient protection in

The 2002 Annual Technical Report comprises the consolidated annual SJRA Operations Report and Vernalis Adaptive Management Plan (VAMP) Monitoring Report.




report documenting the implementation and results of the VAMP program. Specifically, this report includes the following information on the implementation of the SJRA: the hydrologic chronicle; management of the additional SJRA water; installation, operation, and monitoring of the Head of Old River Barrier (HORB); results of the juvenile Chinook salmon smolt survival investigations; discussion of complementary investigations; and, conclusions and recommendations. Condition 4.b of D-1641 directs the Department of Water Resources (DWR) and the U.S. Bureau of Reclamation (USBR) to send the Executive Director, SWRCB the results of the fishery monitoring studies on an annual basis and Condition 7 of D-1641 directs Merced, Modesto, Turlock, South San Joaquin and Oakdale irrigation districts to submit a report detailing district operations as a result of the SJRA. By letter dated September 8, 2000, the SWRCB approved combining these two reports into a single comprehensive report due the SWRCB on January 31, of each year. 

the future. In addition to providing improved protection for juvenile Chinook salmon emigrating from the San Joaquin River system, specific experimental objectives of VAMP 2002 included:

- Quantification of Chinook salmon smolt survival between Durham Ferry and Jersey Point using recapture locations at Antioch and Chipps Island, under conditions of a San Joaquin River flow at Vernalis of 3,200 cfs, with an installed HORB, and SWP/CVP export rate of 1,500 cfs; and
- Comparison of juvenile Chinook salmon survival between Durham Ferry and Mossdale for use in comparing results of VAMP 2002 with results from earlier survival studies where coded-wire tagged (CWT) salmon releases occurred at Mossdale.

The VAMP 2001 Annual Technical Report presented a series of conclusions and recommended modifications to the VAMP experimental design and/or program implementation. The 2001

 See useful web pages

recommendations were used, in part, as the basis for developing the 2002 VAMP test program. For example, the 2001 report recommended weekly measurements of San Joaquin River flow at the Vernalis gage, continued hydrology investigations to estimate ungaged flows (accretions, depletions) to improve hydrologic predictions, and continued coordination among tributary operators to facilitate implementation of the VAMP test flow conditions. As part of the 2002 program, the VAMP Hydrology Group, working in cooperation with tributary operators and USGS, was able to improve our understanding of San Joaquin River hydrology, provide measurements of Vernalis flow, and provide effective coordination of releases from upstream tributaries. 

to improve the ability of the program to detect differences in juvenile Chinook salmon survival among target flow and export conditions. Hydrologic conditions within the San Joaquin River watershed were not suitable for testing extreme target conditions as part of the VAMP 2002 program. These and other recommendations from the 2001 VAMP program were used to improve the overall experimental design and implementation of the 2002 VAMP investigations. Recommendations made based upon analysis of the VAMP 2002 program will also be used, in a similar way, by the VAMP Hydrology and Fishery Biology Groups in developing and implementing the experimental design for the 2003 VAMP studies.

Based on data gathered during the experimental mark-recapture studies that occurred over a 31-day period in April and May 2002,



*To the extent possible, **VAMP** survival testing should be conducted at flow and export extremes to **IMPROVE THE ABILITY** of the program to detect differences in juvenile Chinook salmon survival.*

Contained in the 2001 report were several recommendations including modification of the HORB trash screen design and routine maintenance, continued refinement of operational criteria for culverts, securing all necessary permits for construction of the barrier, measuring flows within each of the culverts, continuing monitoring to evaluate potential impacts of seepage, and improving the experimental design of fishery monitoring in the HORB investigations. These recommendations were addressed as part of the 2002 VAMP program. In addition, the Department of Water Resources (DWR) was successful in securing all of the necessary permits and approvals from the regulatory agencies for the installation of the HORB over the next five years. The landowner access permits for the HORB continue to be renewed annually.

The 2001 report recommended that, to the extent possible, VAMP survival testing be conducted at flow and export extremes

a set of conclusions and recommendations has been developed. These conclusions and recommendations provide guidance and a foundation for design and implementation of future VAMP operations. Key conclusions and recommendations derived from VAMP 2002 include:

- VAMP 2002 is the third year of full implementation of the program. Average Vernalis flow during the VAMP period was 3,300 cfs. SWP and CVP export rate averaged 1,430 cfs. The VAMP period was between April 15 and May 15, 2002.
- Relative recovery rates of CWT salmon released at Durham Ferry and Jersey Point using recaptures at Antioch and Chipps Island indicated that there was no statistical ($P > 0.05$) difference between the two replicates conducted in 2002.
- The proportion of CWT salmon released and recaptured from the combined Durham Ferry and Mossdale groups relative to the proportion of CWT salmon released and recaptured from the Jersey Point (control) releases showed that the relative

- proportions during 2002 (target flow 3,200 cfs and 1,500 cfs exports) were not significantly different ($P > 0.05$) than the proportions from the VAMP 2000 study (target flow 5,700 cfs and 2,250 cfs exports) or VAMP 2001 study (target flow 4,450 cfs and 1,500 cfs exports).
- Streamflow data at Vernalis were improved by weekly flow measurements and rating curve verification, however estimation of ungaged flow (accretions and depletions) requires further investigation for use in establishing annual VAMP target flows. Alternative methods of measuring flow at Vernalis and/or alternative measurement locations should also be investigated.
 - The design of the HORB was unchanged for this year, however rock debris and on going construction activities during the final phases of construction after closure of the barrier proved to be a problem for fishery sampling. Recommendations were made to delay salmon releases at Durham Ferry and Mossdale in future years for a period of approximately 5 days after HORB closure to allow time for gravel and rock to flush from the culverts and to improve fishery sampling at the site. It is recommended that there be improved maintenance of the culverts to reduce debris accumulation.
 - Accurate flow measurements in the San Joaquin River and the Old River near the HORB continue to limit the accuracy of the entrainments correlations. Flows are currently based on extrapolating from upstream measurements, some spot flow measurements in the Old River and San Joaquin River, as well as, estimates of flow through the culverts and seepage through the HORB.
 - Construction of multiple barriers within the south delta during the spring has the potential to delay completion of the construction of HORB and release of the coded wire tagged salmon as part of the VAMP. This delay may contribute to exposure of juvenile Chinook salmon to elevated water temperatures. Due to the high risk of losing major salmon protection benefits and biasing experimental conditions, it is strongly recommended that construction of the HORB be completed on schedule to avoid delays in implementing survival investigations.
- It is also recommended that flow measurements be made to document flow through HORB culverts and the resultant flow within the San Joaquin River downstream of the confluence with Old River.
 - The variability in conducting salmon smolt survival studies in the lower San Joaquin River and Delta makes it difficult to detect statistically significant differences in salmon survival between VAMP flow and export target conditions, which are relatively similar. It is strongly recommended that, when possible, target flow and export conditions be selected to conduct survival tests at VAMP flow and export extremes to improve the ability to detect potential differences in salmon smolt survival among test conditions.
 - Approximately 77 percent of the unmarked salmon migrating past Mossdale between March 15 and June 30, 2002 migrated during the VAMP period (April 15 through May 15) and were, therefore protected by increased San Joaquin River flow, installation of the HORB and decreased export pumping.
 - The selection and management of VAMP flow conditions should, if possible, minimize or avoid requiring upstream tributary flows that adversely affect habitat quality or survival of natural salmon produced within the tributaries. It is therefore recommended that upstream tributary and VAMP studies are coordinated as much as possible.
 - Estimates of salmon survival rates under flow and export conditions tested in 2000, 2001, and 2002 have not been found to be significantly different. Survival tests at extreme target levels (e.g., 7,000 cfs flow and 1,500 cfs exports) are important to obtain. The VAMP program provides improved protection for juvenile salmon when compared to “without-VAMP” conditions. Further tests, over a wider range of flow and export conditions, are needed to evaluate the respective roles of San Joaquin River flow and SWP/CVP exports on juvenile Chinook salmon smolt survival. The report recommends that the VAMP experimental test program be continued.

CHAPTER 1 | INTRODUCTION

The Vernalis Adaptive Management Plan (VAMP) was implemented between April 15 and May 15, 2002 to protect juvenile Chinook salmon and evaluate the relationship between San Joaquin River flow and State (SWP) and federal (CVP) water project exports on survival of juvenile Chinook salmon migrating through the Sacramento–San Joaquin Delta. This represents the third official year of the VAMP experiment.

EXPERIMENTAL DESIGN ELEMENTS

The VAMP experimental design measures salmon smolt survival rates under six different combinations of flow and export rates. The

experimental design includes two mark-recapture studies performed each year during the mid-April to mid-May outmigration period that provide estimates of salmon survival under each set of conditions.

Chinook salmon survival indices under each of the experimental conditions are then calculated based on the numbers of marked salmon released and the number recaptured.

The VAMP 2002 experimental design included both multiple release locations (Durham Ferry, Mossdale, and Jersey Point), and multiple

recapture locations (Antioch, Chipps Island, SWP and CVP salvage operations, and in the ocean fisheries Figure 1-1). Two sets of releases were made at Durham Ferry, Mossdale, and Jersey Point. The use of data from multiple release and recapture locations allows for a more thorough evaluation of juvenile Chinook salmon survival as compared to recapture data from only one sampling location and/or one series of releases. The VAMP coded-wire tag (CWT) releases (Durham Ferry, Mossdale, and Jersey Point) and recapture locations (Antioch and Chipps Island) will be consistent from one year to the next, providing a greater opportunity to assess salmon smolt survival over a range

of Vernalis flows, SWP/CVP exports, and with and without the presence of the Head of Old River Barrier (HORB). Releases at Jersey Point serve as controls for recaptures at Antioch and Chipps Island, thereby allowing the calculation of survival estimates based on the ratio of survival indices from marked salmon recaptured from upstream (e.g., Durham Ferry and Mossdale) and downstream (control release at Jersey Point) releases. The use of ratio estimates as part of the VAMP study design substantially reduces the bias associated with differential gear collection efficiency within and among years, improves the precision associated with the individual survival estimates, and improves confidence in detecting differences in salmon smolt survival as a function of Vernalis flows and SWP/CVP exports.

A quality assurance/quality control program has been used as a routine part of VAMP tests, including the 2002 CWT tagging at the Merced River Fish Hatchery to provide information useful in quantifying CWT tag retention and improving tag efficiency. Modifications were also made during the 2002 program to improve releases at Durham Ferry through coordination with the local landowner to curtail operation of an agricultural diversion pump located immediately downstream of the release site, coincident with each of the two Durham Ferry releases. In addition, the 2002 VAMP program continued use of the net pen studies to determine the health and survival of test fish released as part of VAMP. Efforts also continued to improve the procedure used to statistically analyze VAMP survival and recovery information, however additional improvements remain to be made in the ability to measure flow passing through the HORB culverts and the resultant flow within the San Joaquin River downstream of the confluence with Old River. Measurements in the future of San Joaquin River flow downstream of the HORB will be used to evaluate the relationship between San Joaquin River flow and juvenile Chinook salmon survival.

Additional complimentary studies, including survival studies for juvenile Chinook salmon released into the Mokelumne River tributaries and radio tracking of salmon migrating downstream through Delta channels, were incorporated into the 2002 VAMP investigations.

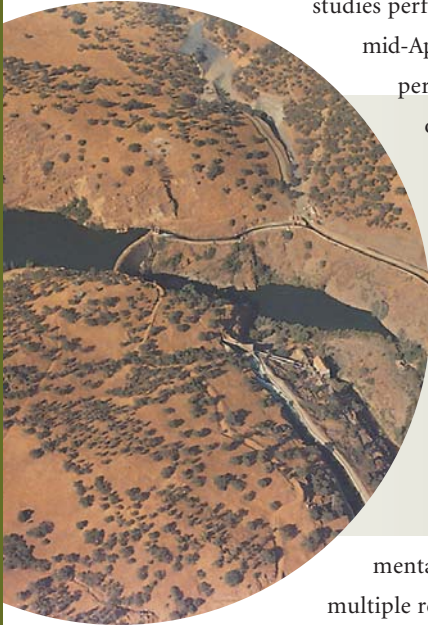


FIGURE 1-1

Sacramento-San Joaquin Estuary



Location of VAMP 2022 Release Sites (Durham Ferry, Mossdale and Jersey Point), Recovery Locations (Antioch and Chipps Island), and Head of Old River Barrier Location Within the Sacramento-San Joaquin River Delta/Estuary.