CHAPTER 7

CONCLUSIONS AND RECOMMENDATIONS

The 2010 VAMP was the first year after three consecutive dry years and the 2009 implementation of the sequential dry-year relaxation of the San Joaquin River Agreement. During 2009, there was no Target Flow. A minimum base flow of 2,000 cfs was maintained in 2009. In contrast, 2010 saw a Target Flow of 4,450 cfs but often flows were higher due to late spring rainfall and cooler than average weather. The VAMP coordinated actions to ensure as closely as possible a stable flow rate at Vernalis during the 2010 VAMP period. The hydrologic conditions for the Water Year 2010 winter were very close to average in the San Joaquin River watershed, with seasonal precipitation in the San Joaquin Hydrologic Region (Cosumnes, Mokelumne, Stanislaus, Tuolumne, Merced and San Joaquin Rivers) measuring 100% of average on April 1, 2010. The mean daily flow at Vernalis varied between 4,210 cfs and 5,890 cfs over the 31-day VAMP period (April 25th to May 25th). The observed exports during this period averaged 1,520 cfs and ranged from 1,320 cfs to 1,560 cfs. The start of the VAMP Fish experiment was delayed to April 25th to May 25th to allow the test fish to increase in size. Flow and fish size were two factors that presented challenges to the VAMP team in meeting their primary goal of demonstrating that acoustic telemetry technology can be implemented full scale in the South Delta.

Many of the difficulties encountered in 2009 were overcome in 2010 and the VAMP team had greater success in deploying and maintaining the large open-water receivers at Chipps Island, tracking smolts through numerous channels, obtaining larger fish for tagging and maintaining an acoustic receiver network throughout the South Delta that has in the past presented challenges to VAMP team in meeting the second goal of better defining route selection and survival between various reaches in the Delta.

The third goal of the 2010 VAMP was to acoustically tag and release fall-run smolts for estimating survival and route selection in various South Delta channels and to Chipps Island. Reaching this goal was still challenged by the time consuming data processing from numerous receivers, data interpretation for smolts that potentially had been consumed by predators in modeling survival through the South Delta and better understanding of the role of observed high mortality within certain reaches within the South Delta. The VAMP Team however made great progress in 2010 in improving the reliability of the data processing procedures and minimized lost data during receiver malfunctions.

Table 7-1
Summary of VAMP 2010 Issues and Recommendations

CHALLENGE OR ISSUE FACED BY VAMP	RECOMMENDATIONS FOR 2011
The timing of VAMP has been designed to adaptively change with hydrologic conditions.	Continue to identify opportunities when it would be beneficial to change the VAMP period to increase protection for juvenile Chinook salmon outmigration from the San Joaquin River Basin.
Low flow conditions in 2009 and high spring flows in 2010 emphasized the importance of the ungaged flow on the San Joaquin River and tributaries.	Maintain and increase the frequency of flow-monitoring station maintenance to ensure accurate flow records.
The San Joaquin River Restoration Flows were first encountered in 2010 and made flow prediction at Vernalis more difficult.	Continue to coordinate with the SJRRP to develop more reliable methods for flow estimation of releases made before and during the VAMP period.
Flow data collected in 2010 near Lathrop, Old River at Head and near Mossdale provided valuable information on the flow split at the Head of Old River.	Continue to use the ADCM flow measurement devices to measure stage and flow at these monitoring sites.
Fish growth pushes the study periord beyond the April 15th – May 15th default period as was used in many of the past years with CWTs.	Continue intensive temperature monitoring throughout the experiment. Work with DFG Hatchery specialists to develop strategies to enhance smolt growth prior to the VAMP period. Continue to improve the use of the TFCF for holding and tagging of smolts as the environmental conditions are similar to Delta conditions
Deployment of large open-water receivers continues to present a strong technical challenge to the VAMP Team.	Develop a long-term commitment with specialist to install these stations
As much as 40% of the study cost in future years may be related to installing the large open-water receivers	Work with the technology manufacturers and other specialists to develop cheaper, long-term solutions for these sites.
Large open-water receivers are a critical component of the survival study and comparisons with prior CWT studies.	Use a consistent study design over multiple years, especially with respect to addressing large-scale questions such as survival to Chipps Island. As part of this recommendation, the large open-water receivers or an alternate technology should be located at Chipps Island each year.
There are numerous routes and channels that the smolts can take in the South Delta especially without the barrier at the head of Old River. Receiver overheating under hot spring Delta conditions.	Continue cooperation with the South Delta Temporary Barriers study and the Non-physical barrier study to maximize the coverage of migration routes with shared acoustic receivers. Use redundant and dual receivers at key locations for route selection analysis and end points for the survival modeling. All future telemetry sites exposed to outdoor ambient conditions should utilize the modified joboxes developed during the 2009 VAMP study (Vogel, 2010). Work should continue on other modifications to help improve internal temperatures within the joboxes.
Assessing the importance of route selection at the head of Old River with a non-physical barrier installed and assessing associated predation.	Deployment of a four-port receiver at the head of Old River whether a non-physical barrier is installed or not should be a priority to assess detailed fish behavior and potential predation.
Interference from line power sources.	Continue to restrict the use of AC trickle chargers unless grounding and acoustic noise can be eliminated.
Use of acid batteries presents labor and safety issues.	Use of non-acid batteries should be implemented to avoid safety issues in remote areas. Development of solar panels for trickle charging should be developed and tested in 2011.
Tag life is still near the limits of time needed for travel through the Delta.	Continue the tag life studies using methods initiated in 2008. Continue to distribute tags from all tag manufacture groups across all release groups and taggers so that any survival effect of release group (location, time) or tagger is not confounded with a potential effect of tag batch or tag life on survival.
Availability of test fish from the San Joaquin River Basin.	Develop a long-term supply source from the Merced River Hatchery (MRH) to ensure a continuous source of in-basin smolts. Discontinue the use of Feather River Hatchery Fish as were used in 2009 as they may not be representative of the survival of juvenile salmon originating from the San Joaquin River Basin.

Table 7-1 (continued)
Summary of VAMP 2010 Issues and Recommendations

CHALLENGE OR ISSUE FACED BY VAMP	RECOMMENDATIONS FOR 2011
Minimizing mortality after tagging and smolt releases.	Evaluate the benefits of supplemental releases near Stockton and in Old River to supplement the number of tagged fish that make it to Chipps Island
	Continue evaluation of tagger effects.
	Continue health studies on release groups.
	Consider additional live-pen studies in reaches of highest mortality with a priority in the Stockton Deep Water Ship Channel and near the Stockton WWTP.
	Continue dummy tagging of release fish
	Continue tagger training and continued development of refresher training courses for previous taggers.
	Work with groups to develop long-term availability of previous taggers to ensure consistency in tagging procedures.
	Evaluate assumptions on how predation is determined for tagged smolts under San Joaquin River conditions.
	Evaluate if acoustic-tagged salmon are in "sub-standard condition" resulting from surgery and transport (Vogel, 2010)
	Consider conducting predator avoidance tests on representative tagged salmon using established study protocols (Vogel, 2010).
	Continue mobile telemetry to locate high mortality areas or zones.
Loss of data due to receiver malfunctions or vandalism.	Develop remote log-in techniques to continuously check on receiver operations.
	Work with the University of Washington and others to identify critical receiver locations and assure data is gathered with minimal downtime.
	Use redundant receivers at key stations to avoid critical data loss including Mossdale, SJR at Lathrop, Old River East side and Chipps Island.
Data processing is time consuming and expensive due to labor costs.	Continue the use of a central ftp site for data downloads to avoid loss of data prior to processing.
	To ensure consistency in how data is processed, develop standardized procedures for how data is handled, reviewed, stored and processed.
	Plan precisely who will be processing data from each receiver and how the transfer of processed data will occur.
	Develop training programs for data processors.
	Develop procedures to compare manual processing with computer marking programs to evaluate accuracy under Delta conditions.
Difficulty in distinguishing between tags in live smolts versus those in predators for the survival estimates.	Do not rely solely on the "presence/absence" data processing techniques.
	Develop standard terminology for data analysis including standard definitions for "near-filed, medium-filed and far-field" observations used in the 2009 VAMP study to ensure consistency in data processing and interpretation.
	Continue with some manual data processing to assess the benefits of classifying detections as predator-type movements vs. smolt type movements.
	Work with the acoustic tracking manufacturers to develop more rapid marking programs that identify specific types of smolt behavior.
	Conduct modeling using both all detections and only those characterized as being in smolts.

Table 7-1 (continued)
Summary of VAMP 2010 Issues and Recommendations

CHALLENGE OR ISSUE FACED BY VAMP	RECOMMENDATIONS FOR 2011
Due to high mortality, very few tagged smolts released upstream of Vernalis reach as far downstream as Turner Cut, Jersey Point or Chipps Island.	Focus future work to better define the reason for the high mortality in specific reaches of the Delta and San Joaquin River. Consider supplemental releases to determine if mortality experiences in the upper reaches of the San Joaquin River are similar to those found further downstream and to ensure that enough tagged smolts reach Chipps Island to allow a more robust survival modeling effort.
Continued high mortality in certain reaches and near certain points in the river that may or may not be associated with predation.	Evaluate acoustic-tagged salmon smolts to determine if they are in a "sub-standard" condition resulting from surgery and transport causing increased vulnerability to predation compared to untagged salmon. Increase predator tagging with an emphasis on tagging prior to the start of the tagged smolt release to allow the predators time to adjust and move to locations they are accustomed to during the out-migration period. Develop a full study plan for predator tracking to ensure consistency and allow data interpretation between studies. Tag predators in known "hot spots" such as bridges, pumping structures, scour holes, etc. to better learn about their habitats during the smolt out-migration period. Continue mobile monitoring in known predator areas and in the main stem of the San Joaquin River as most acoustically-tagged predators may not hang out around fixed station receivers. Conduct an acoustic-tag defecation study to determine how long transmitters remain in the stomach of predators. Work with the tag manufacturers to develop a smolt tag that shows different characteristics when it is consumed or in the stomach of a predator.