Annual Progress Report to the Collaborative Science Policy Group

Prepared by:

The Collaborative Adaptive Management Team (CAMT)

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1.0 Introduction

Purpose

This document provides the second annual progress report on the Collaborative Science and Adaptive Management Program (CSAMP) being undertaken in the Sacramento—San Joaquin River Delta.

Content and Scope

The report documents the activities, achievements, and future plans of the program's Collaborative Adaptive Management Team (CAMT) operating under the leadership and guidance of the Collaborative Science Policy Group (Policy Group). The report includes highlights of ongoing collaboration (including accomplishments from 2014), and an updated CAMT Workplan for 2015. Throughout the report, the term "CSAMP" is used to refer to the overall process, which encompasses the CAMT and the Policy Group. The term "CAMT" refers specifically to the team of individuals that make up CAMT.

To date, CSAMP has focused on controversial science issues directly related to a motion to extend the court-ordered remand schedule for completing revisions to salmonid (NMFS 2009) and Delta Smelt (FWS 2008) Biological Opinions (BiOps). Moving forward, it has been suggested that the CSAMP could expand its scope to address other policy-science interface issues and adaptive management matters. While there are opportunities to leverage the trust built among CAMT and Policy Group members, CAMT recommends that its primary focus in 2015 be on finishing what it has started. However, CAMT also recommends initiating exploratory discussions on three new initiatives in 2015, as described in Sections 2 and 4 of this report. As CSAMP continues to transition from planning to implementation, the CAMT anticipates generating substantive science information in 2015 that will directly impact future management actions.

CSAMP Value and Outcomes

The CSAMP was established, in part, to break the cycle of litigation and work collaboratively on science and adaptive management. Over the past year, the Policy Group and CAMT have demonstrated that collaboration has the potential to yield better understanding and more broadly supported science. Equally important, CSAMP is building trust among the parties that could have lasting value if the process is sustained.

The goal of the CAMT is to produce information through a collaborative process that is directly relevant to management actions in the Delta. This information is intended to be used to affect management operations that protect fish while providing for greater water supply reliability. This includes examining the science underlying specific actions contained in the current BiOps, developing new information, and examining information that has become available in the years since the BiOps were developed.

Lessons Learned

The following are key lessons learned to date:

- **Building Trust and Legitimacy.** Trust is fundamental for a legitimate, effective collaboration, and it takes time and resources to build this foundation.
- **Achieving Credibility.** Engaging recognized experts and an independent peer review process with the leadership and support of the Delta Science Program (DSP) has been critical to ensuring the process is credible.
- **Achieving Relevance.** Sorting through the myriad of possible research projects that could be pursued and selecting those that are relevant to key management issues requires careful deliberation and input from multiple parties, and is an iterative process.

Challenges Moving Forward

Key changes for the CSAMP moving forward are:

- **Ensuring Adequate Resources.** The limiting factors for CSAMP are committed resources, including the availability of the right people, money, and time to produce credible products.
- **Securing Additional Funding.** To date, CSAMP has functioned based on in-kind staff commitments and near-term funding provided by various participants. Moving forward, it will be necessary to secure additional funding to conduct investigations that address the high priority items outlined in the CAMT Workplan.
- **Coordinating with IEP and Other Established Science Infrastructure.** CSAMP should not operate in a vacuum. We strongly believe that the partnerships built through CSAMP should be expanded to leverage knowledge, expertise, and limited resources available.
- **Planning for the Future.** To date the CSAMP has focused on the development and evaluation of scientific information that will inform the parties to the operations litigation. It has been suggested that the CSAMP play a more direct role in adaptive management and expand its purview to include issues outside of the operations litigation, like habitat restoration. These changes would significantly alter the current effort and will need careful planning.

Costs and Funding

The CAMT estimates the total cost for the three-year CSAMP process (February 2013 through February 2016) will be approximately $5 million. This includes existing and projected expenditures to (1) operate and sustain the CSAMP, (2) engage the DSP to provide peer reviews that are critical to maintaining a credible process, and (3) scope and fund scientific investigations. The CAMT, working with the Policy Group has secured $2.8 million in committed funds for the CSAMP process. An additional $2.2 million will be needed to complete the high priority work elements identified by CAMT. Of this $2.2 million, approximately $1.5 million will be needed in 2015. The remaining $700,000 will be needed to fund activities projected to occur in the first two quarters of 2016. The CAMT has not developed budget estimates beyond the first two quarters of 2016, but some of the work described in Section 4 below, particularly plans to develop and fund Requests for Proposals (RFPs) for salmonid studies, are expected to extend into the later-half of 2016. Appendix A provides additional information regarding CSAMP funding and estimated cash flow needs for 2015 and 2016.

2.0 Background

The CSAMP was launched following a decision by the United States District Court for the Eastern District of California. On April 9, 2013 the decision entitled "Memorandum Decision and Order regarding Motion to Extend Remand Schedule" (Court Order) was issued in response to a motion to extend the court-ordered remand schedule for completing revisions to salmonid and Delta Smelt BiOps.

The Court Order allowed the parties making the motion (i.e., U.S. Bureau of Reclamation, U.S. Fish and Wildlife Service, National Marine Fisheries Service, and the California Department of Water Resources) additional time for the development of a proposed "robust science and adaptive management program, with collaboration of the scientists and experts from the Public Water Agencies ('PWAs') and the NGO community" with the intent to "inform the development and implementation of the BiOps" (Lohoefener 2012 and included in O'Neill 2013[1]). In April 2013, the Court granted a one-year extension of time. The parties filed a joint status report in February 2014, and the Court granted a second one-year extension in March 2014. In the intervening period, the Ninth Circuit reversed the Court's decision with respect to the smelt BiOp and issued a final judgment. Thus, the Fish and Wildlife Service is no longer subject to the jurisdiction of the Court and is not required to prepare a new BiOp. Further, the Supreme Court denied review of the case. In December 2014, the Ninth Circuit reversed the Court's decision with respect to the salmonid BiOp. In the meantime, all parties remain committed to the collaborative development of scientific information that will inform sound decision-making in the future.

Organization

The CSAMP is structured as two-tiered organization comprised of: (1) a Policy Group made up of agency directors and top-level executives from the entities involved in the litigation, and (2) the CAMT including designated managers and scientists to serve as a working group functioning under the direction of the Policy Group. Technical support is provided by two scoping teams, one for Delta Smelt and one for salmon, comprised of scientists representing the CAMT members.

Mission Statement

The CAMT mutually agreed on the following mission statement at its July 23, 2013 meeting:

> The Collaborative Adaptive Management Team (CAMT) will work, with a sense of urgency, to develop a robust science and adaptive management program that will inform both the implementation of the current Biological Opinions, including interim* operations; and the development of revised Biological Opinions.
>
> *The term "interim" refers to the period during which revised Biological Opinions are being developed.

[1] Add reference

Priority Topics for 2015

For 2015, CAMT intends to remain focused on the high priority topic areas outlined in 2014:

1. Improved application of Delta Smelt survey data;
2. Old and Middle River (OMR) flow management and entrainment of Delta Smelt;
3. Fall outflow management for Delta Smelt; and
4. South Delta salmonid survival.

In addition to these priorities, CAMT recommends initiating discussion on three other controversial science-policy issues in 2015:

1. Habitat restoration for native Delta fishes;
2. Factors influencing salmonid restoration beyond the south Delta and export pumping; and
3. Effects of project operations on the location of X2 in the fall.

The third initiative above regarding the location of X2 in the fall was originally identified as part of the 2014 Delta Smelt investigations, but additional expertise in hydrodynamics is needed that is beyond the expertise of the current Delta Smelt Scoping Team, and thus the item will be further discussed within the CAMT in 2015.

Relationships to other Adaptive Management Programs and Research

There are several research programs and adaptive management efforts outside of the CSAMP. The CSAMP does not replace those efforts or reduce their importance. Instead, the CSAMP will supplement and inform them.

The CSAMP will provide a new approach to integrating stakeholder points of view into these processes, or to create new groups if necessary to collaboratively address BiOp-related questions. The CAMT intends to ensure that disagreement about the basis for, and effectiveness of the reasonable and prudent alternatives (RPAs) be addressed by a science-based process that is legitimate, credible, and relevant to stakeholder concerns.

3.0 Accomplishments

Activities in 2014 focused on high priority workplan elements outlined in the CAMT 2013 Progress Report. In accordance with the process agreed upon by CAMT in 2013 (see CAMT Progress Report, February 14, 2013), CAMT focused on: (1) scoping investigations, (2) conducting investigations, and (3) working with the DSP to provide independent peer reviews. Specific accomplishments in 2014 included:

- Formation of scoping teams to address key management issues related to Delta Smelt and salmonids;
- Preparation of a draft proposal to examine Delta Smelt survey data (see Appendix B);
- Development and DSP review of a detailed proposal to investigate Delta Smelt entrainment, and the population impacts of entrainment (see Appendix C);
- Formation and engagement of investigative teams to work on Delta Smelt entrainment and fall outflow;
- Preparation and DSP review of a Salmonid Gap Analysis concept paper (see Appendix E);
- Preparation of a draft Salmonid Gap Analysis Report (see Appendix G);

The CAMT formed two scoping teams, the Delta Smelt Scoping Team (DSST) and the Salmonid Scoping Team (SST). The two teams scoped investigations, interacted with other scientists doing related work, reviewed existing data and analyses, developed workplans for conducting new investigations, and prepared synthesis reports. Given the remand BiOp timeframe, both scoping teams focused on review and analysis of existing datasets, including new data collected since 2008, rather than on the collection of new field data.

Consistent with the CAMT mission statement, the scoping teams worked collaboratively with a sense of urgency to develop robust science that would achieve CAMT goals of relevancy, legitimacy, and credibility. Balancing the sense of urgency and relevance to near-term management decision making with the desire to produce legitimate and credible science has been a challenge. Science by nature is a deliberative process that takes time. Collaborative science that effectively engages multiple parties, including parties with divergent views, takes even more time.

In 2014, the CAMT scoping teams worked diligently to meet the aggressive timelines established in the 2014 CAMT Workplan while at the same time ensuring adequate deliberation and independent review to maintain a legitimate and credible process. Not all the high priority Workplan elements were completed in 2014, but significant progress was made on a number of critically important topics, as described in more detail below. Equally as important, CSAMP is building trust among the parties that will serve as a foundation for better understanding and more effective management moving forward. Table 3-1 provides a summary status report of the specific work elements articulated in the 2014 CAMT Workplan. A narrative summary of accomplishments relative to each of the four high priority topic areas is provided following Table 3-1.

Table 3-1 Status of 2014 Workplan Elements

2014 Work Element	Status	Comments
Fall Outflow Management for Delta Smelt		
1-1 Review monitoring methods for Delta Smelt.	Ongoing Will continue in 2015	Proposal developed in 2014 (see Appendix B). To be reviewed and implemented in 2015.
1-2 Investigate importance of fall period for Delta Smelt.	Ongoing Will continue in 2015	Proposal team assembled and discussions initiated in 2014. Proposal to be developed, reviewed and implemented in 2015 and 2016.
1-3 Investigate effects of fall outflow on Delta Smelt.	Ongoing Will continue in 2015	Combined with 1-2 above.
1-4 Examine project impacts on fall outflow.	Starting in 2015	Secondary priority in 2014 workplan.
1-5 Investigate importance of summer period for Delta Smelt	Ongoing Will continue in 2015	Secondary priority in 2014 workplan. To be addressed as part of 1-2 above.
1-6 Investigate the relationship between fall outflow and habitat attributes.	Ongoing Will continue in 2015	Secondary priority in 2014 workplan.
OMR Management and Delta Smelt Entrainment		
2-1 Assess factors affecting adult Delta Smelt entrainment.	Ongoing Will continue in 2015	Proposal developed and reviewed in 2014 (see Appendix C and D). To be implemented in 2015 and 2016.
2-2 Assess population effects of entrainment on Delta Smelt.	Ongoing Will continue in 2015	Combined with 2-1 above.
2-3 Develop a better estimate of adult Delta Smelt entrainment.	Ongoing Will continue in 2015	Secondary priority in 2014 workplan. Combined with 2-1 above.
2-4 Develop a better estimate of post-larval Delta Smelt entrainment	Future activity	Secondary priority in 2014 workplan.

2-5 Evaluate conditions that affect adult movement prior to spawning	Ongoing Will continue in 2015	Secondary priority in 2014 workplan. Combined with 2-1 above.
2-6 Assess factors affecting larval and post-larval Delta Smelt entrainment	Future activity	Secondary priority in 2014 workplan.
2-7 Explore alternative management actions	Ongoing Will continue in 2015	Secondary priority in 2014 workplan. Combined with 2-1 above.
South Delta Salmonid Survival		
3-1 Synthesize published reports and empirical data on water export effects and identify/document scientific agreements and disagreements regarding the effects of south Delta water operations on juvenile salmonid survival in the Delta (gap analysis).	Ongoing Will continue in 2015	Proposal developed and reviewed in 2014. Draft report prepared in 2014. Report to be revised, reviewed and finalized in 2015. See Appendices E, F, and G).
3-2 Provide a briefing about SWFSC winter-run salmonid life cycle model LCM).	Completed	
3-3 Prepare data synthesis and meta-analysis.	Ongoing Will continue in 2015	Combined with 3-1 above.
3-4 Pending results of the gap analysis and initial data synthesis efforts, investigate alternative metric(s) for management of south Delta water operations.	Starting in 2015	See 2015 Workplan element 4-3-3
3-5 Re-charter the SDSRC.	Completed	
3-6 Pending outcomes of Elements 1, 3, and 4, investigate tools to evaluate the efficacy of export management actions.	Starting in 2015	Secondary priority in 2014 workplan. Combined with 3-4 above.

3-7	After briefing on SWFSC LCM, assessment of other potential modeling needs. Pending outcomes of Elements 1-4 identify and evaluate indirect ecological effects of project operations that affect the survival of listed salmonids.	Starting in 2015	Secondary priority in 2014 workplan. See 2015 Workplan element 4-1-2
3-8	Define an expanded scope to include indirect ecological effects of south Delta water operations	Starting in 2015	Secondary priority in 2014 workplan. See 2015 Workplan element 4-1-2.
3-9	Enhanced learning from 6-year steelhead study (NMFS BiOp RPA VI.2.2)	Starting in 2015	Secondary priority in 2014 workplan. See 2015 Workplan element 4-1-2.
3-10	Salmonid near-field movement under selected export and tidal conditions.	Starting in 2015	Third priority in 2014 workplan. See 2015 Workplan element 4-3-4.
3-11	Pending gap analysis, investigate hatchery- and natural-origin salmonid surrogacy.	Starting in 2015	Third priority in 2014 workplan. Combined with 3-1 above.

Summary Status of 24 Work Elements from 2014
Completed - 2
Ongoing. Will continue in 2015 - 12
Starting in 2015 – 7
Future Activity - 2

Improved Application of Delta Smelt Survey Data

One of the high priority 2014 Workplan elements for Delta Smelt focused on concerns regarding existing monitoring programs for Delta Smelt and the potential for unintended sampling bias that could affect various analyses regarding Delta Smelt presence/absence, movement, and distribution. The DSST prepared a scope of work and requested a detailed proposal from an expert in fish sampling design (see Appendix B).

Table 3-2 provides a summary of the proposed study. The proposal recommends evaluating foundational assumptions that underlie data analysis methods used to draw conclusions about the population status of Delta Smelt. The study would evaluate assumptions regarding catchability and temporal and spatial correlation to ensuring that the survey programs in the Delta are providing reliable and accurate population metrics for Delta Smelt. The draft proposal is currently being revised based on discussions with the DSST, with an independent review anticipated in February or March 2015. The DSST will continue to discuss concerns regarding ongoing Delta Smelt monitoring surveys and may engage additional technical experts and initiate additional evaluations.

Table 3-2 Proposed Review of Delta Smelt Survey Data

Investigator	Dr. Robert Latour
Description	This project is designed to address foundational assumptions that underlie data analysis methods used to draw conclusions about the population status of Delta Smelt.
Key Questions	1. Catchability a) Are there specific covariates that significantly affect catchability of Delta Smelt by the FMWT and SKT survey programs? b) If changes in survey catchability for Delta Smelt are detected, can 'correction' factors be applied to Delta Smelt survey data for the purpose of generating alternative FMWT and SKT abundance indices? 2. Independence of survey samples a) Is there evidence of temporal/spatial autocorrelation among survey samples of Delta Smelt collected by the FMWT and SKT survey programs? b) If notable temporal/spatial autocorrelation is detected, can Delta Smelt abundance indices be re-estimated by taking into account the inherent correlation structure of the FMWT and SKT survey samples?
Management Relevance	Formally evaluating key assumptions regarding catchability and sampling independence is critical to ensuring that the survey programs in the Delta are providing reliable and accurate population metrics for Delta Smelt. Understanding the accuracy of the survey data is essential for evaluating the effectiveness of current management actions, and identifying potentially more effective alternative actions.
Deliverable	A formal testing of the underlying assumptions regarding current survey techniques and recommendations for possible correction factors (if needed)
Start Date	March 1, 2015
End Date	September 30, 2015
Budget	$ 100,000

Old and Middle River (OMR) Flow Management and Entrainment of Delta Smelt

Two of the high priority CAMT Workplan elements identified in 2014 focused on OMR flow management and questions regarding Delta Smelt entrainment at the Central Valley Project (CVP) and State Water Project (SWP) export facilities in the south Delta (CAMT 2014 Workplan Elements 3-2-1 and 3-2-2). The first element focused on environmental factors affecting entrainment, while the second focused on the population level effects of entrainment. The DSST developed scopes of work for both elements and engaged a team of independent technical experts to develop detailed proposals for conducting investigations.

The two CAMT entrainment Workplan elements were combined into a single project proposal prepared for the DSST in October 2014 (see Appendix C). Table 3-3 provides a summary of the proposed investigation. The proposal recommends conducting four interrelated studies:

- The first study will provide a retrospective analysis of historical data to improve our understanding of factors that may affect entrainment risk. The study will revisit the existing conceptual models to determine if new studies or information (e.g., factors) can be used to better understand salvage patterns as an improvement from earlier investigations.
- The second study proposes using a suite of hydrodynamic, water quality, and particle tracking models, referred to collectively as an individual-based model (IBM), to identify adult Delta Smelt behaviors that best explain movement towards SWP and CVP, and entrainment.
- The third study proposes to estimate adult Delta Smelt proportional losses to SWP and CVP entrainment using the modeling tools developed in study two above.
- The fourth study will re-examine life cycle model results published by Maunder and Deriso (2011) using updated data sets (i.e., post-2005) and revised assumptions to determine what levels of entrainment affect the viability of the Delta Smelt population.

An independent, design-level peer review of the proposal was completed in December 2014 (see Appendix D). Following the review, the investigative team members met with the DSST to discuss review comments and where modifications to the proposed approach might be made. This interaction helped to improve understanding of the proposal and the review comments, and it is expected to promote legitimacy as well as management relevance. The investigative team is currently preparing a formal written response to the review comments and revising its proposal. Depending on available funding, CAMT anticipates initiating the technical investigations in the first quarter of 2015, as outlined in the 2015 Workplan.

Fall Outflow Management for Delta Smelt

Another high-priority 2014 Workplan element for Delta Smelt involved looking at the importance of fall outflow (see CAMT 2014 Workplan elements 3-1-2 and 3-1-3). The DSST prepared a scope of work in the summer of 2014 and engaged an independent team of technical experts to prepare a detailed proposal. The fall outflow investigative team is currently in the process of preparing the proposal, which is anticipated in February 2015. Following a DSST review, the proposal will be sent to the DSP for an independent peer review. Table 3-4 provides a summary of the proposed investigation. The proposed schedule for completing the fall outflow studies is shown in the 2015 Workplan.

Table 3-3 Proposed Investigation of Delta Smelt Entrainment

Investigators	Lenny Grimaldo – Principal Investigator Rick Deriso Edward Gross Josh Korman Pete Smith Bryan Manly Mark Maunder Michael McWilliams
Description	This project consists of four interrelated investigations to assess the factors that affect Delta Smelt entrainment and the population consequences of entrainment: Proposal 1 –Critically review the conceptual models that underlie adult Delta Smelt salvage and determine through multi-regression models the best suite of variables that explain historical salvage patterns. Proposal 2 - Evaluate adult Delta Smelt swimming behaviors and how those behaviors driven by the environmental conditions of turbidity, salinity, and Delta flows, affect adult delta smelt entrainment at the south Delta export facilities. Proposal 3 - Estimate proportional losses from entrainment of adult Delta Smelt at the SWP and CVP export facilities in the south Delta. Proposal 4 – Use existing life cycle model to understand the effects of entrainment on the Delta Smelt population.
Key Questions	See listing below
Management Relevance	Results from this study could be used to better characterize high risk and low risk scenarios for different operational decisions. They could also indicate how effective the RPAs have been at reducing entrainment. Results will also put entrainment in context with the overall population to estimate the effect of various entrainment levels on the Delta Smelt population as a whole, which will allow for more informed management decisions.
Deliverables	Modeling and analytical tools that could support adjustments and refinements to current RPAs that could provide better species protection and improvements to water supply reliability.
Start Date	March 1, 2015
End Date	May 31, 2016
Budget	Proposal 1: $ 70,000 Proposal 2: $ 410,000 Proposal 3: $ 250,000 Proposal 4: $ 170,000 Total: $ 900,000

Key questions to be addressed by the Delta Smelt entrainment proposal:

1. Is there a relationship between Delta Smelt distribution and habitat conditions (e.g. turbidity, X2, temperature, food) during fall and subsequent distribution and associated entrainment risk in winter?
2. What are the environmental conditions that "trigger" spawning migration?
3. How does the distribution of adult Delta Smelt vary at time scales not resolved by surveys, particularly during the spawning migration?
4. Which environmental conditions lead to adults entering the south Delta?
5. To what degree has implementation of the RPA reduced adult entrainment?
6. What are the salvage efficiencies of the major water export facilities?
7. What is the best feasible method for estimating the number of adults entrained by the water projects?
8. What is the relationship between salvage and entrainment, how variable is the relationship, and what factors influence that variability?
9. What are the effects of entrainment on the population?

Table 3-4 Proposed Investigation of Fall Outflow for Delta Smelt

Investigators	Erica Fleishman– Principal Investigator Rick Deriso Lenny Grimaldo Nobel Hendrix Mark Maunder Robin Wapples
Description	This project will identify environmental variables that are associated strongly with annual changes in survival during autumn and recruitment of Delta Smelt.
Key Questions	1. What is the strength of association between fall outflow, autumn survival and recruitment of Delta Smelt? 2. What is the strength of association between environmental covariates and autumn survival and recruitment of delta smelt if fall outflow is not included in the model?
Management Relevance	A better understanding of how fall conditions affect Delta Smelt survival and recruitment, and the role of outflows versus other environmental conditions could result in more effective management actions and potentially a revised RPA.
Deliverables	Modeling analyses that identify the significance of various factors on fall survival and the relative value of managing these conditions to provide species protection.
Start Date	May 1, 2015
End Date	April 30, 2016
Budget	$ 750,000

South Delta Salmonid Survival

The CAMT SST has focused primarily on the review and synthesis of available science on water project-linked effects on salmonid survival, referred to as a gap analysis (CAMT Progress Report, Workplan Element 3-3-1, February 14, 2014). Key factors considered by NMFS in the 2009 BiOp include salmonid survival in the southern Delta, recovery planning, assessing population resiliency, and population recovery.

The SST gap analysis is intended to provide NMFS and others with a collaboratively developed assessment of technical information regarding SWP and CVP operations, changes in Delta hydrodynamics, salmonid migration rates and route selection, and salmonid survival. The SST expects the gap analysis to yield both recommendations and guidance on future research in addressing the influence of water project-linked effects on juvenile salmonid migration and survival within the Delta, and lessons based on existing scientific research that can inform resource management decisions. Table 3-5 provides a summary of the salmonid gap analysis.

The SST prepared a concept paper on July 14, 2014 outlining its proposed approach for conducting the gap analysis entitled "*Identification and Prioritization of Gaps in the Current Understanding of the Water Project-Linked Effects on Juvenile Salmonid Survival in the South Delta"* (see Appendix E). The paper was reviewed by CAMT and forwarded to the DSP for an independent, design-level peer review on July 25, 2014. On September 18, 2014, the DSP Lead Scientist provided the results of that review to CAMT and the SST (see Appendix F).

The SST prepared a draft Gap Analysis Report in November 2014 synthesizing existing information and describing initial findings and recommendations (see Appendix G).

Delta Science Program Reviews

A key commitment for 2014 was the engagement of the DSP in organizing and conducting independent peer reviews at both the design stage and the product stage of CAMT investigations. These reviews have provided essential credibility to the program. In 2014, the DSP organized two reviews for CAMT:

- Review of the Delta Smelt Entrainment proposal (see Appendix D).
- Review of the SST concept paper on the Salmonid Gap Analysis (see Appendix F).

In 2015, CAMT anticipates additional DSP organized reviews for the draft Salmonid Gap Analysis Report, the Delta Smelt monitoring survey evaluation proposal, the Delta Smelt fall outflow proposal, and the draft Delta Smelt entrainment evaluation report.

Table 3-5 Proposed Gap Analysis for Salmonids

Investigators	CAMT Salmon Scoping Team (SST)
Description	This project provides a review and synthesis of available science on water project-linked effects on salmonid survival, and provides recommendations for further applied research.
Key Questions	See list below
Management Relevance	Salmonid survival in the southern Delta is a key factor considered by NMFS in the 2009 BiOp and recovery planning for assessing population resiliency and population recovery. There is a range of views regarding the effects of south Delta hydrodynamics, as affected by San Joaquin inflow and/or delta exports, on the survival of salmonids emigrating from the San Joaquin through the south Delta. The Gap Analysis and subsequent RFPs will summarize areas of scientific agreement and disagreement and indicate fruitful areas for expending funds on additional research to narrow areas of disagreement.
Deliverables	The gap analysis will provide a synthesis of published reports and empirical data on the effects of south Delta water operations on juvenile salmonid survival in the Delta as well as documentation of scientific agreements and disagreements specifically related to the key questions identified by the CAMT. Results of the gap analysis will yield recommendations and guidance on future research needed to better understand the influence of water project-linked effects on juvenile salmonid migration and survival within the Delta. Reducing uncertainties in how management of water operations affect patterns of survival and mortality will promote more effective management actions.
Start Date	May 1, 2014
End Date	Gap analysis report - May 31, 2015 RFP studies – 2016
Budget	$ 450,000 ($400,000 would be for funding RFP responses in 2016)

Key questions to be addressed by the Salmonid Gap Analysis:

1. To what extent do SWP and CVP export operations affect water velocity and flow direction at selected locations in the Delta, and to what extent do those changes influence salmonid migration rate, route selection and survival?
2. To what extent do either: (1) water exports; (2) inflows; or (3) the ratio of San Joaquin River inflow to water exports during April and May affect the survival of Chinook salmon or steelhead out-migrating down the San Joaquin River, particularly given very low ambient rates of survival and associated issues of detection?
3. To what extent does the January 1 onset of OMR flow management improve the survival of the target salmonid species?
4. To what extent do salvage-density-based export restrictions improve survival of targeted populations of Chinook salmon and/or steelhead?

5. In considering the effectiveness of flow metrics as a management tool, are there alternative or additional metrics (e.g., OMR flows, export volumes, monthly export limits, etc.) that could be used to manage south Delta water operations, and improve survival of migrating salmonids in the south Delta?
6. Are there biological response metrics that would be useful for assessing the effectiveness of RPA actions (for example, as suggested in Anderson et al. 2014, pages 5, 42)?
7. Do DSM2 Hydro and/or other available hydrodynamic models provide outputs that are appropriate and useful for assessing how exports from the south Delta, river inflows, and tides may influence the magnitude, duration, and direction of water velocities within selected channels and channel junctions in the Delta? What are the strengths and limitations of various simulation models and their application to assessing the relationship between water project operations and salmonid migration and survival?
8. What information is needed to address concerns that the results of tests using hatchery-reared fall-run Chinook salmon may not be representative of results of other runs of natural-origin salmonids? Could a correction factor be developed to allow for application of such test results?

4.0 Workplan for 2015

The CAMT Workplan for 2015 is provided in tables 4-1 through 4-3 below. The 2015 Workplan focuses primarily on completing work initiated in 2014, but also includes some new initiatives. New initiatives for 2015 (as shown in Table 4-1) will initially involve direct discussions within CAMT, rather than within either of the two existing scoping teams. Ongoing efforts related to Delta Smelt and salmonids (see Table 4-2 and 4-3) will continue to be guided by the scoping teams (DSST and SST), as overseen by CAMT.

New initiatives for 2015 include looking at habitat restoration, which was discussed in 2013 but tabled due to concerns regarding adequate resources, and looking at expanding the scope of the salmonid activities. The CAMT also proposes to pick up one of the 2014 workplan elements originally slated for the DSST regarding the effect of project operations on the location of X2 in the fall.

With regard to habitat restoration, CAMT proposes to host a series of meetings and workshops to examine the work currently being done on habitat restoration as a platform for determining if there is additional science, or science-policy dialogues that CAMT could initiate that would complement the work already occurring. With regard to salmonids, once the initial gap analysis has been completed, CAMT proposes to discuss expanding the scope of the studies to examine a broader suite of factors affecting salmonid survival such as predation (including predation that may be indirectly related to project operations), and to examine a broader geographic area beyond the south Delta. Depending on the outcomes of these discussions, specific investigations may be identified.

Workplan elements for Delta Smelt and salmonids focus primarily on completing the high priority work elements previously identified in 2014 including efforts to examine and improve the application of existing Delta Smelt survey data, examining OMR management and effects of Delta Smelt entrainment and populations, and examining the effects of water project operations on salmonid behavior and survival in the south Delta.

The 2015 CAMT Workplan reflects a good-faith effort on the part of the CAMT to respond to the urgency of its mission while recognizing that resource constraints, changing circumstances, or unexpected events could impact proposed schedules. For example, the timely availability of third-party investigators has not been confirmed. Uncontrollable circumstances, such as the drought, may impose additional priorities that may further impact schedules.

Coordinating with Ongoing Studies

In 2015, CAMT will continue to leverage existing activities and monitoring to add value and avoid duplication of efforts. This may include reviewing ongoing data collection and monitoring programs to assess the need for possible refinements that could improve the applicability of the data for evaluating the key questions and hypotheses articulated by CAMT. Responsibility for coordinating and integrating CAMT activities with other ongoing studies will rest with the CAMT scoping teams.

Coordinating with the Delta Science Program

CAMT anticipates continuing to work with the DSP in 2015 to provide independent peer reviews with the goal of increasing the quality of the work performed and ensuring credibility in the process. The 2015 Workplan outlines specific areas where DSP reviews are planned.

Table 4-1 CAMT 2015 Initiatives

Work Element	Key Question(s)	Status	Schedule	Budget
1. **Restoration** - Review efforts to examine the effectiveness of habitat restoration for improving conditions native fishes.	How can CAMT add value to ongoing studies on the effectiveness of habitat restoration? Can CAMT play a role in advancing implementation of habitat restoration from a science and adaptive management perspective?	To be initiated in 2015. CAMT discussions to include presentations of ongoing work. Outcomes to include decisions regarding the value of further CAMT engagement.	Second Quarter 2015	NA[2]
2. **Phase 2 Salmonid Activities** - Discuss factors affecting juvenile salmonid survival in the Delta and tributaries.	See list below.	To be initiated in 2015. Outcomes to include decisions regarding the scope of additional CAMT investment.	Third Quarter 2015	NA[1]
3. **Fall X2** - Examine project impacts on fall X2.	How much variability in tidal, daily, weekly and monthly fluctuations in fall X2 is attributable to water project operations?	To be initiated in 2015, including presentations on existing evaluations. Outcomes to include a decision on potential CAMT investment.	Third Quarter 2015	NA[1]

The following key management questions identified by CAMT are beyond the scope of the salmonid gap analysis , but could be addressed in a later phase of the CAMT salmon efforts. These questions deal with broader effects of project operations on salmonid survival:

1. To what extent do project-related hydrodynamic effects and project driven water movements and reservoir practices influence predation, and what information is needed to inform management of any project-related predation effects?
2. What are the indirect ecological effects of water export and project driven water movements, temperatures and reservoir practices; and are there management actions that would minimize indirect project effects that influence salmonid survival?
3. What are the most likely tools to invest in, either in terms of monitoring or modeling, to improve our ability to assess the real-time distribution of juvenile salmonids and juvenile losses in the Delta and in the Sacramento River system?
4. Are there experimental modifications of the 6-year steelhead study that would enhance the understanding of the effect of inflow/export conditions on south Delta survival of steelhead?
5. How well do current hydrodynamic simulation models with behavior algorithms predict actual migration rate and route selection of juvenile salmonid within the Delta and the Sacramento River system and, how well do the current passage/survival and lifecycle models predict survival observed in CWT and acoustic tag survival studies?

[2] This work element will involve discussion within the CAMT and will not require any capital expenditures beyond dedicated staff time.

Table 4-2 CAMT 2015 Delta Smelt Workplan

Work Element	Key Question(s)	Status	Schedule	Budget[3]
1. **Application of Delta Smelt Survey Data** - Review Delta Smelt survey data.	Are there issues associated with the existing survey data sets such as random sampling bias that could affect the application of that data for supporting management decisions? If such issues exist, are there correction factors that could be applied to improve the application of the survey data for management?	Proposal received. See Appendix B.	Design-level review – Feb 2015 Revised proposal – Mar 2015 Draft report – Jun 2015 Product review – Jul 2015 Final report – Sep 2015	$100,000
2. **OMR Flow Management and Entrainment of Delta Smelt** - Assess factors affecting adult Delta Smelt entrainment and population effects.	What factors affect adult Delta Smelt entrainment during and after winter movements to spawning areas? What are the effects of entrainment on the population?	Proposal developed and reviewed. See appendices C and D.	Revised proposal – Feb 2015 Draft report – Oct 2015 Product review – Dec 2015 Final report – May 2016	$900,000[4]
3. **Fall Outflow Management for Delta Smelt** - Investigate effects of fall outflow on Delta Smelt and the importance of the fall period for Delta Smelt.	Under what circumstances do environmental conditions in the fall season contribute to determining the subsequent abundance of Delta Smelt? Under what circumstances does survival in the fall affect subsequent winter abundance?	Proposal under development.	Draft proposal – Mar 2015 Design-level review – May 2015 Revised proposal – Jul 2015 Draft report – Dec 2015 Product review – Feb 2016 Final report – Apr 2016	$750,000[5]
4. **Survey Improvements** - Coordinate with ongoing gear efficiency and survey reviews.	How can CAMT add value to ongoing reviews and analyses to examine monitoring surveys by IEP and others?	To be initiated in 2015.	First Quarter 2015	NA[6]

[3] Budget estimates are project totals and include anticipated expenditures in 2015 and 2016.
[4] Approximately $780,000 needed in 2015 with the remaining $120.000 needed in the first half of 2016.
[5] Approximately $375,000 needed in 2015 with the remaining $375.000 needed in the first half of 2016.
[6] This work element will not require any capital expenditures beyond dedicated staff time.

Table 4-3 CAMT 2015 South Delta Salmonid Survival Workplan

Work Element	Key Question(s)	Status	Schedule	Budget
1. **Gap Analysis** - Synthesize published reports and empirical data on water export effects; and document scientific agreements and disagreements regarding the effects of south Delta water operations on juvenile salmonid survival in the Delta.	See list below	Draft report completed. See Appendix E.	CAMT Workshop – Feb 2015 Revised draft report – May 2015 Product review – Jun 2015 Final report – Aug 2015	NA[7]
2. **Life Cycle Model** - Briefing on status of SWFSC winter-run salmonid life cycle model (LCM).	How is the LCM being used to evaluate scenarios, and what additional scenarios could be evaluated using the model?	Second briefing	Feb 2015	NA[6]
3. **Alternative Metrics** - Pending results of the gap analysis and initial data synthesis efforts; investigate alternative metric(s) for management of south Delta water operations.	In considering the effectiveness of flow metrics as a management tool, are there alternative or additional metrics that could be used to manage water operations, and improve survival of migrating salmonids in the south Delta?	To be initiated in 2015	To be determined based on results of Gap Analysis	$50,000
4. **RFPs** - Guide development of RFPs to implement recommendations from the Gap Analysis.	See list below	To be initiated in 2015	Develop RFP(s) – Jun-Jul 2015 Issue RFP(s) – Aug 2015 Review Proposals – Sep 2015 Award Project(s) – Oct 2015 Initiate Studies – Jan 2016	$400,000[8]

[7] This work element will not require authorization of new capital expenditures
[8] Estimated funds needed in 2016 for re through the RFP process

Key Phase 1 salmonid management questions identified by CAMT:

1. To what extent do SWP and CVP export operations effect water velocity and flow direction at selected locations in the Delta? To what extent do those specific hydrodynamic changes influence salmonid migration rate or route selection, and salmonid survival? Export operations of concern include export rates and installation/operation of gates and barriers, including the Clifton Court Forebay radial gates, the Head of Old River barrier, and south Delta agricultural barriers. CAMT requests that the SST develop a discrete list of locations to study.
2. To what extent do either: (1) water exports; (2) inflows; or (3) the ratio of San Joaquin River inflow to water exports during April and May affect the survival of Chinook salmon or steelhead out-migrating down the San Joaquin River, particularly given very low ambient rates of survival and associated issues of detection?
3. To what extent does the January 1 onset of OMR flow management improve the survival of the target salmonid species?
4. To what extent do salvage-density-based export restrictions improve survival of targeted populations of Chinook salmon and/or steelhead?
5. In considering the effectiveness of flow metrics as a management tool, are there alternative or additional metrics (e.g., OMR flows, export volumes, monthly export limits, etc.) that could be used to manage south Delta water operations, and improve survival of migrating salmonids in the south Delta?
6. Are there biological response metrics that would be useful for assessing the effectiveness of RPA actions (for example, as suggested in Anderson et al. 2014, pages 5, 42)?
7. Do DSM2 Hydro and/or other available hydrodynamic models provide outputs that are appropriate and useful for assessing how exports from the south Delta, river inflows, and tides may influence the magnitude, duration, and direction of water velocities within selected channels and channel junctions in the Delta? What are the strengths and limitations of various simulation models and their application to assessing the relationship between water project operations and salmonid migration and survival?
8. What information is needed to address concerns that the results of tests using hatchery-reared fall-run Chinook salmon may not be representative of results of other runs of natural-origin salmonids? Could a correction factor be developed to allow for application of such test results?