Collaborative Science and Adaptive Management Program Biennial Report 2022 - 2023

Prepared for:

The Collaborative Science and Adaptive Management Program Policy Group

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Final

Current CSAMP Membership and Representatives

Policy Group

Jeff Sutton	Tehama-Colusa Canal Authority
Alison Febbo	Westlands Water District
Gary Bobker	The Bay Institute
Charlton "Chuck" Bonham	CA Department of Fish and Wildlife
Ernest Conant	U.S. Bureau of Reclamation
Tom McCarthy	Kern County Water Agency
Joaquin Esquivel	State Water Resources Control Board
Nina Hawk	Metropolitan Water District of Southern California
Karla Nemeth	CA Department of Water Resources
Deanna Sereno	Contra Costa Water District
Bill Phillimore	Coalition for a Sustainable Delta
Jason Phillips	Friant Water Authority
Kaylee Allen	U.S. Fish and Wildlife Service
Cathy Marcinkevage	National Marine Fisheries Service
Virginia Madueno	Delta Stewardship Council
Jay Ziegler	Delta Water Master
Ashley Overhouse	Defenders of Wildlife

Collaborative Adaptive Management Team (CAMT)

Matt Nobriga	U.S. Fish and Wildlife Service
Cindy Meyer	San Luis Delta Mendota Water Authority, representing Public Water Agencies
Henry DeBey	Delta Science Program
Steve Culberson	Interagency Ecological Program
Rene Henry	Trout Unlimited, representing The Nature Conservancy, The Bay Institute, and Defenders of Wildlife
Steve Lindley	National Marine Fisheries Service, Southwest Fisheries Science Center
Kris Jones	CA Department of Water Resources
Sam Luoma, Co-Chair	UC Davis, representing The Nature Conservancy, The Bay Institute, and Defenders of Wildlife
Mario Manzo	U.S. Bureau of Reclamation
Darcy Austin, Co-chair	State Water Contractors, representing Public Water Agencies
Cathy Marcinkevage	National Marine Fisheries Service
Sam Bashevkin	State Water Resources Control Board
Lucinda Shih	Contra Costa Water District
Vacant	CA Department of Fish and Wildlife

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Program Manager Reflections

In 2023, the Collaborative Science and Adaptive Management Program (CSAMP) marked its 10th year. Since its inception, CSAMP has been an experiment. An experiment to test whether collaboration around science could result in better outcomes, both for fish and for water supplies. Over the years CSAMP has tried a variety of approaches to collaboration from staff lead co-production efforts (e.g. Salmon Gap Analysis) to hiring independent investigators (e.g. Delta Smelt entrainment studies) to hosting workshops (e.g. Winter Run Life Cycle Model Stakeholder Forum).

We've tested not only how to generate technical information through collaboration, but how to advance understanding by socializing that information through dialog, both horizontally and vertically. We've learned from each endeavor, and we've evolved.

We've evolved from a court ordered collaboration of litigants in 2013 focused narrowly on the effects of Central Valley Project (CVP) and State Water Project (SWP) operations in the south Delta, to a voluntary collaborative of upstream and downstream interests in 2017 focused more broadly on species recovery. We've grown in size and representation, and we've lost representation, particularly representatives of the environmental and fishing communities in 2022 over Voluntary Agreement efforts occurring outside CSAMP.

Maintaining a voluntary collaborative of CSAMP's breadth (currently 17 organizations representing state and federal agencies, non-governmental organizations [NGOs] and public water agencies) for ten years is no small accomplishment, particularly when you consider CSAMP's focus (water management and recovery of endangered fish species in the Delta). Beyond longevity, CSAMP has produced an impressive list of technical products. Just in the past two years (2022 and 2023), CSAMP has achieved a number of significant milestones, including the completion of long-standing studies on Old and Middle River (OMR) flow management and Fall Outflow, both of which are now published in the scientific literature. CSAMP also completed two reports on monitoring in the Delta, undertook a significant effort to synthesize research on salmonid survival in the South Delta and continued to support two major structured decision-making efforts, as noted below.

Despite CSAMP's accomplishments, Delta Smelt and Central Valley salmonid populations have continued to decline over the past ten years, and are at historically low levels. This suggests that more is needed in order to achieve CSAMP's stated purpose (to improve performance both from a biological and a water supply perspective). Acknowledging this fact, CSAMP invested heavily in 2022 and 2023 in two broad-scale structured decision-making initiatives to identify management actions (and portfolios of management action) that could reverse the decline of Delta Smelt and Central Valley salmonids, and support recovery. Both of these initiatives have engaged the best available science, including state-of-the-art life cycle models, and both have demonstrated that recovery is possible.

Demonstrating the art of the possible via modeling is of course very different from implementing actions and actually achieving recovery, but it's a start. Socializing these findings and working together to chart a path to implementing meaningful recovery actions is, in my view, one of CSAMP's next big challenges.

Other key challenges include:

- Navigating numerous, concurrent regulatory activities that are tapping CSAMP member agency leadership and staff capacity, and impacting engagement in CSAMP; and
- Addressing lost leadership and engagement associated with the withdrawal of three NGO participants in 2022 and the retirement of several long-standing CSAMP leaders.

Among the key leaders that retired, or withdrew from CSAMP in the past two years are Kate Poole, Frances Brewster, Steve Arakawa, Tom Birmingham, Carl Wilcox and Dick Pool. These names are familiar to anyone involved with California Water over the past three decades. I would be remise if I did not acknowledge, and thank them for their commitment to CSAMP over the years, and acknowledge the impact of their departure from the CSAMP conversation.

Results from interviews with CSAMP members conducted in early 2024 indicate that CSAMP members highly value the CSAMP forum as a place for candid dialog between state and federal agencies, NGOs and water agencies. That said, many members noted reduced engagement and capacity challenges as significant concerns. There were several suggestions for possible changes that included: exploring how to increase engagement, effectiveness, and impact; expanding membership; playing a more active role in informing policy; working across programs to reduce duplication; and pausing CSAMP until the regulatory landscape is more settled and agency staff can more meaningfully engage.

CSAMP will be discussing this input over the coming months in an effort to set its future course. I look forward to that conversation. As we have in the past, I think it's important for CSAMP to evolve to ensure that it is meeting the needs of its members and continues to be value added. I'm confident that the respectful dialog, candor and commitment to collaboration that has served as our guiding light for the past ten years will continue to guide us toward better understanding, and a well-informed decision.

Sincerely,

Bruce DiGennaro
CSAMP Program Manager

1.0 Introduction

This report summarizes activities of the Collaborative Science and Adaptive Management Program (CSAMP or Program) during calendar years 2022 and 2023. The purpose of the report is to highlight progress relative to CSAMP's objectives and priorities, and to provide a foundation for setting CSAMP's course moving forward.

This introduction provides a brief history of CSAMP, and a description of its organizational structure as background. Section 2 of the report presents CSAMP's purpose and approach. Section 3 presents CSAMP's overall goal, objectives and priorities for 2022-2024. Section 4 presents a progress report on CSAMP's activities and accomplishments over the past two years relative to its objectives and priorities. Finally, Section 5 presents findings from a series of interviews conducted with CSAMP members in February 2024, including suggestions for improvements that could be made to improve the overall value of CSAMP.

1.1 History

Federal and state agencies proposed establishment of CSAMP in late 2012 amidst ongoing litigation over the 2008 and 2009 Biological Opinions (BiOps) addressing the impacts of continuing operation of the Central Valley Project and State Water Project on listed species. CSAMP was launched following a decision by the United States District Court for the Eastern District of California on April 9, 2013, to extend the court-ordered remand schedule for completing revisions to Biological Opinions.

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 to develop a proposed robust science and adaptive management program. The program was designed to include collaboration of the scientists and experts from Public Water Agencies (PWAs) and non-governmental organizations (NGO's) to inform the management actions incorporated into the existing BiOps (and Reasonable and Prudent Alternatives) and to consider alternative management actions.

In 2015, the Ninth Circuit reversed the Court's decision with respect to the smelt and salmonid BiOps and issued a final judgment, thereby ending the Court Order. In the absence of the Court Order, all parties agreed to continue CSAMP to promote the collaborative development of scientific information to inform sound decision-making into the future.

In 2017, CSAMP modified its purpose and broadened its scope to include examining opportunities to advance species recovery, recognizing that a narrow focus on SWP and CVP water operations alone would not be sufficient to achieve its broader goals. In concert with this change, CSAMP expanded its membership to include PWAs on the Sacramento and San Joaquin rivers and in the Delta, as well as additional NGOs.

In 2022, three NGOs, the Natural Resources Defense Council (NRDC), Golden State Salmon Association (GSSA) and Pacific Coast Federation of Fishermen's Association (PCFFA) withdrew from CSAMP over concerns related to the signing of the Voluntary Agreement regarding the Water Quality Control Plan Update.

1.2 Organization

CSAMP is structured as a four-tiered organization comprised of:

1. A Policy Group consisting of agency directors and top-level executives from the entities that comprise CSAMP;
2. The Collaborative Adaptive Management Team (CAMT) made up of managers and senior level scientists that serve at the direction of the Policy Group;
3. Scoping Teams and Technical Working Groups (TWGs) created on an as-needed basis to scope and/or engage in specific science studies and discuss study results; and
4. Investigators contracted to conduct specific research or planning studies.

A listing of current CSAMP Policy Group and CAMT members is provided at the beginning of this report.

2.0 CSAMP Purpose and Approach

CSAMP's current purpose and approach is summarized below.

2.1 Purpose

In 2017, the CSAMP Policy Group adopted the following purpose statement:

> *Work with a sense of urgency to collaboratively evaluate current hypotheses and management actions associated with protection and restoration of species of concern, current and future federal and state regulatory authorizations for the SWP and CVP, and other local and state management actions, to improve performance from both biological and water supply perspectives.*

In adopting this purpose statement, CSAMP consciously broadened its scope to include examining opportunities to advance species recovery, recognizing that a narrow focus on SWP and CVP water operations alone would not be sufficient to achieve its broader goals. This decision has resulted in two significant, multi-year structured decision-making (SDM) projects focused on Delta Smelt and salmonids which have been a significant focus for CSAMP since 2019 and 2021 respectively.

2.2 Approach

CSAMP seeks to achieve its purpose through the following approach:

1. *Provide a FORUM for communication among the State and Federal agencies, Non-governmental Organizations (NGOs) and Public Water Agencies (PWAs);*
2. *Act as a CATALYST to address the most contentious and urgent management relevant science issues; and*
3. *COMPILE AND DISSEMINATE INFORMATION for decision makers on contentious and urgent science issues in a timely fashion.*

These three functions are further described below.

2.2.1 Providing a Forum – CSAMP should be a venue where issues, alternative hypotheses, and alternative management approaches can be thoroughly and openly discussed by all involved agencies and stakeholders. It should be a forum for meaningful discussion that promotes understanding, identifies areas of agreement and disagreement, and facilitates better informed management decisions. If an issue is not to be heard, all should understand why. CSAMP is not a decision-making body and should not become an institution in-and-of itself.

2.2.2 Acting as a Catalyst – CSAMP should (1) be a catalyst for integration of scientific information to inform policy makers and (2) be a venue for proposing and vetting potential changes to management actions and monitoring schema based on such information in order to maximize their effectiveness while minimizing their costs and impacts on society, recognizing that decisions regarding changes must ultimately be made by the agency or agencies with decision-making authority. Part and parcel of this effort, CSAMP should address urgent and contentious issues taking the initial steps to define the issue, define the differences in understanding and areas of agreement and disagreement, promote common understanding (narrow the differences) and fund science where appropriate, and tee up trade-offs for policy makers. If the activity requires a long-term investment, CSAMP should find the appropriate entity to address the issue and report back to CSAMP on a regular basis.

2.2.3 Compiling and Disseminating Information - CSAMP should be the trusted provider of key information. This includes compilation of data, analyses of findings, critical assessment of that information, and synthesis of that information in order to aid policy makers. The information provided should be complete; with the pros and cons as appropriate. CSAMP should not strive for consensus, but it should always provide well thought out information and associated rationale. Members must be able to understand the source and essence of both agreement and disagreement being discussed.

3.0 CSAMP Goal, Objectives and Priorities

In May 2022, CSAMP adopted an overarching goal statement, four objectives and three priorities to guide work activities in the 2022-2024 period. Its adopted goal statement focused on CSAMP's role as a forum for dialog and information sharing.

3.1 Overarching Goal

Serve as a forum for dialog and information sharing, with the goal of facilitating mutual understanding and identifying common ground regarding science and adaptive management.

3.2 Objectives

1. Communicate and understand different perspectives;
2. Complete in-progress technical work and let others take up future investigations;
3. Identify areas where members can speak with a unified voice; and
4. Discuss metrics and monitoring (i.e. are current monitoring programs providing the data on metrics of interest needed to inform management decisions?).

3.3 Priorities

3.3.1 Facilitate Recovery Planning and Adaptive Management - Work together to advance common goals for the recovery of species of concern in the Delta and Central Valley using an adaptive management approach. Improve coordination, integration and synthesis of information across agencies and projects.

3.3.2 Improve Science-Policy Dialog – Utilize CSAMP as a venue to present and discuss the state of knowledge, uncertainties and disagreements regarding the science underlying specific management actions. Identify and discuss emerging science, including science regarding long-term management challenges such as climate change, drought and rapidly changing environmental conditions in the Delta.

3.3.3 Advance Improvements in Monitoring – Work collaboratively to identify and assist agencies on incorporating improvements into the monitoring enterprise.

For each priority area, CSAMP identified specific work activities to focus on during the 2022-2024 period. Progress on these specific activities, as well as overall progress towards achieving its objectives and priorities is described in the following section.

4.0 Progress Report

Over the past two years, CSAMP has continued to serve as a forum for communication, coordination and engagement on matters associated with the conservation of listed fish species within the Sacramento San Joaquin Bay-Delta Estuary and the operations of the Central Valley Project (CVP) and the State Water Project (SWP). This has included significant engagement of technical working groups, stakeholder workshops and presentations to managers and executives in an effort to advance a robust science-policy dialog. The following highlights progress towards achieving CSAMP's objectives and priorities for the 2022-2024 period. All reports noted below can be found on CSAMP's website at https://www.baydeltalive.com/CSAMP/csamp%20main/csamp-main.

4.1 Communicating and Understanding Different Perspectives

Throughout 2022 and 2023, CSAMP held monthly CAMT meetings, monthly Policy Group calls, quarterly Policy Group meetings and workshops focused on sharing science information, including findings from CSAMP studies as well as other science initiatives. These meetings and workshops provided regularly scheduled opportunities to communicate and advance understanding, including understanding of different perspectives. Dialog at these meetings and workshops was typically focused on CSAMP's three priorities (facilitating recovery planning and adaptive management, improving the policy-science dialog and advancing improvements in monitoring). These activities highlight CSAMP's role as an ongoing forum as well as its role in compiling and disseminating information.

Some of the specific topics discussed by CSAMP in 2022 and 2023 included the following:

- Delta Smelt Structured Decision Making *(Policy Group, January 2022, October 2022, June 2023 and December 2023)*
- Salmonids Reorienting to Recovery *(Policy Group, January 2022 and September 2023)*

- Delta Smelt Experimental Release *(CAMT, January 2022, January 2023 and October 2023)*
- CSAMP Monitoring Assessment Task 1 Report *(Policy Group, January 2022)*
- The Emerging Threat of Thiamine Deficiency in Salmon *(Policy Group, April 2022)*
- 2022-2026 Science Action Agenda *(Policy Group, April 2022)*
- FY 2020-2021 Delta Cross-Cut Budget Report *(Policy Group, July 2022)*
- Monitoring Enterprise Review, Independent Science Board *(Policy Group, July 2022)*
- CSAMP Monitoring Assessment Task 2 Report *(Policy Group, July 2022)*
- Directed Outflow Project Technical Reports 3 and 4 *(Policy Group, July 2022 and CAMT, September 2023)*
- Delta Coordination Group *(Policy Group, October 2022)*
- CSAMP Fall Outflow Study *(Policy Group, March 2023)*
- 6 Agency Monitoring Redesign *(CAMT, April 2022 and Policy Group, March 2023)*
- Delta Science Program Science Tracker *(CAMT, April 2023)*
- State of Bay Delta Science Report *(CAMT, April 2023)*
- Salmon Hatchery Releases *(CAMT, May 2023)*
- Central Valley Project Improvement Act, Habita Restoration *(CAMT, October 2023)*

One of the more significant CSMAP undertakings in 2022 focused on establishing a better understanding of the monitoring enterprise in the Delta, including a review of previous monitoring assessments, and an internal assessment of CSAMP member objectives for monitoring. This effort was specifically conducted in support of Priority 3 (advance improvements in monitoring), but also supported Priority 2 (improve science-policy dialog). The effort is also a good example of CSAMP acting as a catalyst. The effort resulted in an improved understanding of what individual CSAMP members needs are relative to monitoring and highlighted that CSAMP members share very similar objectives regarding monitoring. The assessment also highlighted that there are concerns, and different perspectives regarding how the existing monitoring programs are funded, and whether additional public funds should be dedicated to status and trends monitoring. Specific products and outcomes of the CSMAP Monitoring Assessment are described under Section 4.4. below.

CSAMP also continued to host a monthly stakeholder forum focused on the Winter Run Life Cycle Model (WRLCM) throughout 2022. This forum provided opportunities for technical staff to understand the WRLCM and provide input on updates to the model. As part of this stakeholder forum, CSAMP sponsored a workshop in June 2022 on the enhanced particle tracking model (ePTM2) developed to support the WRLCM.

Acting in its catalyst role, CSAMP also held a series of discussions focused on structuring and organizing an adaptive management workshop in support of CSAMP Priority 1 (facilitate recovery planning and adaptive management). The outcomes of these discussions were passed on to the Delta Science Program in support of their ongoing adaptive management workshop series consistent with Objective 2, which promotes passing work to others (see Section 4.2 below for more details on these discussions and their outcomes).

4.2 Completing Technical Work and Passing Work to Others

CSAMP made significant progress on completing technical work in 2022 and 2023, including the completion of long-standing studies focused on Old and Middle River (OMR) flow management and Fall outflow. As of March 2024, CSAMP had completed, or nearly completed five of its nine workplan activities. Two activities were transferred to other entities for completion, and two were paused, as listed below.

Completed, or Nearly Completed

- Fall Outflow Study *(completed in July 2022)*
- Winter Run Life Cycle Modeling (WRLCM) Stakeholder Forum *(ended in November 2022)*
- OMR Management - Adult Delta Smelt Entrainment Study *(completed in December 2023)*
- South Delta Salmonid Survival Study *(final report expected in April 2024)*
- Delta Smelt Structured Decision-Making (SDM) – Round 1 *(to be completed by August 2024)*

Transferred

- Salmonid Reorienting to Recovery *(transferred to Delta Science Program, with funding from U.S. Bureau of Reclamation)*
- Adaptive Management Workshop *(transferred to Delta Science Program)*

Paused

- Monitoring Assessment *(Phases 1 and 2 completed in 2022, Phase 3 framework under development by PWAs)*
- Delta Smelt Program Manager (paused in 2022)

Consistent with Objective 2, CSAMP has looked to pass technical work to others where it made sense. This includes the Salmonid Reorienting to Recovery project that was initiated by CSAMP in 2020 and subsequently funded by the Delta Science Program and U.S. Bureau of Reclamation beginning in 2022. It also includes work on an adaptive management workshop as noted above, which was ultimately passed to the Delta Science Program. Work on Phase 3 of the Monitoring Assessment was also handed off to the PWA's in 2023, but is expected to come back to the CSAMP table for further discussion in 2024.

CSAMP also spent time in early 2022 discussing the roles and responsibilities of a Delta Smelt Program Manager whose responsibilities would include focusing on Delta Smelt recovery and overseeing science and adaptive management related to recovery, consistent with Priority 1.

The following describes the progress made over the past two years on projects related to Objective 2, which supports CSAMP's role largely in compiling and disseminating information. For each project we provide a brief description of its status, a description of products produced and a discussion of associated outcomes.

4.2.1 OMR Management - Adult Delta Smelt Entrainment (*completed*)

Description and Status – In 2015, CSAMP commissioned a series of four interrelated scientific investigations designed to examine management of Old and Middle River (OMR) flows and entrainment of adult Delta Smelt. The studies examined: (1) factors affecting salvage at the CVP and SWP facilities; (2) distribution estimates for

hypothesized swimming behaviors and statistical evaluation of particle-tracking models; (3) proportional entrainment loss (PEL); and (4) the use of life cycle models to estimate the impacts of estimated PELs on the Delta Smelt population. The first two studies were completed in 2020 and published in the San Francisco Estuary and Watershed Science Journal (Volume 19, Issue 1, 2021). Studies 3 and 4 were completed in 2022 and 2023 respectively.

Products – Reports associated with all four studies were prepared by the respective investigators. Reports for Study 1, 2 and 4 are available at https://csamp.baydeltalive.com/camt%20delta%20smelt%20work/delta-smelt-technical-studies. The report for Study 3 has not been posted due to USGS staff participation and the need to secure approval from USGS before posting the report. As noted above, papers describing the first two studies were published in a peer reviewed journal.

Outcomes:

- Information generated from the Studies 1 and 2, as reported in earlier CSAMP Progress Reports reinforce and build upon results of previous work suggesting adult Delta Smelt entrainment risk can be assessed and managed using a combination of factors including exports and/or OMR (i.e., hydrodynamics), turbidity, previous Fall Midwater Trawl index (abundance), precipitation, and river flows.
- Results from Study 3 show significant variations in PEL for the wide variety of biological and physical conditions that occurred during the 36-year period studied. For the period beginning with water year 2002, the highest losses are in the first five years (2002-2006) with estimates of 27%, 40%, 39%, 16%, and 6%, respectively. After 2006, losses have all been 4% or less in the 10 years studied (through 2016) and, in eight of those 10 years, the losses are below 2%.
- Results from Study 4 show that, at least within the MDR life-cycle model framework, sub-adult Delta Smelt survival is significantly and negatively correlated with PEL. Lower PEL scenarios resulted in increasing or stable populations while higher PEL scenarios resulted in population declines. The lowest PEL scenario had the largest population growth.
- A comparison of modeled scenarios indicates that consistently low rates of PEL could result in a stable or growing Delta Smelt population. In scenarios where the PEL remained below 4%, the population did not markedly decline. Since 2009, estimated PEL has remained in this range indicating that entrainment of sub-adults is unlikely to be limiting population growth at present, but could have contributed to declines that occurred during the early 2000s.
- Results from Study 4 indicate that in the absence of efforts to reduce Delta Smelt entrainment, population declines between 2009 and 2016 likely would have been

more severe. Persistently low Delta Smelt abundances in recent years in spite of substantial reductions in entrainment suggest that other conditions now constrain Delta Smelt population growth.

4.2.2 Fall Outflow Study (*completed*)

Description and Status - In 2016, CSAMP commissioned a modeling study to examine the relationships between outflow in the fall and the occupancy of Delta Smelt. The study was completed in 2022. Findings from the study were discussed with the CSAMP Policy Group in March 2022.

Products – A final manuscript was published in Estuaries and Coasts in July 2022 (https://link.springer.com/article/10.1007/s12237-022-01100-x). CSAMP's Delta Smelt Scoping Team (DSST) also prepared a summary memo in February 2023 describing the study, outlining other relevant studies for additional context and presenting several recommendations (see Appendix A)

Outcomes:

- The model providing the best fit to FMWT Survey catch data incorporated salinity and water temperature as occupancy covariates; and fish length, sample volume, and water clarity as detection covariates.
- Occupancy was clearly most responsive to salinity, and detection most responsive to water clarity.
- Patterns of occupancy in "wet" and "dry" falls were similar, suggesting Cache Slough and the lower Sacramento River to Suisun Bay represent "core" habitat for Delta Smelt.
- The DSST found these basic study outcomes to be unsurprising, given that salinity and water clarity are known critical features of Delta Smelt habitat.
- The DSST concluded that the investigation had made positive contributions to understanding fall flow effects on Delta Smelt habitat through the application of new and more sophisticated analytical techniques, including highlighting the importance of evaluating detection.
- The DSST also concluded that the results of the investigation were insufficient by themselves to guide fall flow management.
- The DSST identified potential follow-on scientific efforts, but did not recommend pursuit of these follow-on efforts before the CSAMP Delta Smelt Structured Decision Making (SDM) Project had run its course.

4.2.3 South Delta Salmonid Survival (*nearly complete*)

Description and Status – In 2022, the CAMT formulated the following charge questions related to salmon survival, routing, and behavior through the South Delta:

- What does analysis post the 2017 Salmon Scoping Team (SST) report have to tell us about how exports influence salmon and steelhead survival through the South Delta (i.e., now that telemetry data for more years has been analyzed and processed)?

- Are any of the conclusions of the SST related to survival changed or strengthened because we have additional data? If not, what study results would allow new/different/firmer conclusions to be reached?
- What is the impact of exports relative to other factors influencing juvenile salmonid survival in the Delta? (e.g., what does acoustic telemetry data tell us about how foraging/sheltering/migrating behavior may be impacted by export altered hydrodynamics?)
- How do juveniles respond (survival, behavior, growth) to the different operations based on flow dynamics in different water year types?
- For each question, does the Science Integration Team (SIT) model take into account this new information and are tools reflective of what we are seeing in the science (e.g., will changes in operations based on water year type be reflected in juvenile response)?

In order to address these five specific questions, a Salmon Technical Working Group (STWG) was convened to review literature published since the SST report was issued in 2017 regarding salmon and steelhead emigrating from the San Joaquin River and engage with researchers.

Products – The STWG anticipates distributing their final report in April 2024. A presentation of the key findings was shared with the Policy Group in September 2023.

Outcomes – The STWG did not set out to achieve consensus - but as it turned out, their disagreements were more focused on the implications of the findings as opposed to their veracity. For example, while no adverse effect was found in association with total export rates during outmigration under the conditions observed, the group was divided as to what the findings suggest about how water projects should be operated. Seeing as additional years of telemetry data are unlikely to answer this fundamental question, the STWG recommends pivoting from studying exports as we have been, to focusing on improving survival at various scales by identifying, recreating, testing, and building upon the conditions where/when salmonids have had success (i.e., higher survival).

4.2.4 Winter Run Life Cycle Model (WRLCM) Stakeholder Forum *(completed)*

Description and Status – CSAMP, working closely with the National Marine Fisheries Service (NMFS) and the Southwest Fisheries Science Center initiated a series of workshops in 2017 to advance stakeholder understanding of the existing Winter-run Chinook Salmon Life Cycle Model (LCM) developed by NMFS Southwest Fisheries Science Center (SWFSC). These workshops continued through 2022 with monthly stakeholder meetings, and occasional workshops to discuss in-progress updates to the WRLCM. The workshop series was discontinued at the end of 2022 due to lack of funding.

Products – With input from stakeholders, NMFS developed a website for the WRLCM that includes postings of presentations provided to the Stakeholder Forum as well as details regarding model updates.

Outcomes – The WRLCM Forum served to facilitate transparency, improve understanding of the model and provide an opportunity for stakeholders to offer input on updates to the model, including submodels on fish behavior and movement in the Delta (ePTM2) and fish growth.

4.2.5 Adaptive Management Workshop *(transferred)*

Description and Status – At the end of 2021, PWA members suggested that it could be useful to schedule a special session of the Policy Group to share and discuss different perspectives regarding adaptive management and how it can be better employed in the Delta. CAMT formed a subcommittee in July 2022 to explore planning for such a workshop, including how the workshop could be structured and what specific issues might be discussed.

Products – The CAMT subcommittee produced several slide presentations in the third quarter of 2022 outlining a proposed workshop structure and topics for discussion.

Outcomes – Due to concerns regarding CSAMP capacity, and the recognition that the Delta Science Program (DSP) maintains an ongoing Adaptive Management workshop series, with workshops conducted every other year on the subject, the CAMT subcommittee recommended that the project be transferred to the DSP and be incorporated into subsequent DSP sponsored workshops. Outcomes from subcommittee and CAMT discussions included the following:

- There aren't disagreements about the overall AM concepts/steps. Disagreements are more about details of how it's done.
- It appears that parties may have different expectations for adaptive management and how to define success.
- There could be value in spending time discussing objectives, hypotheses and the need for pre-planning adaptive management experiments.
- There could be value in discussing how decisions are made based on what's learned.
- There could be value in walking through specific examples. For example, deconstructing implementation of the Summer-Fall Outflow Action and lessons learned.

4.3 Identifying Where Members Can Speak with a Unified Voice

Progress towards achieving Objective 3 is best reflected in CSAMP's ongoing Structured Decision-Making (SDM) effort for Delta Smelt, and CSAMP's continued support for the Salmond Reorienting to Recovery project, which also involves the use of SDM techniques. Both of these projects directly support CSAMP Priority 1 (facilitate recovery planning and adaptive management) and CSAMP Priority 2 (improve science-policy dialog). Through these planning projects, CSAMP members are working together to advance common goals for the recovery of species of concern in the Delta and Central Valley. The projects specifically seek to improve

coordination, integration and synthesis of information across agencies and projects. They also represent examples of CSAMP's role as a catalyst.

Both projects are focused on identifying and evaluating management actions, and portfolios of management actions that would advance recovery of Delta Smelt and salmonids. Both projects rely on structured decision-making techniques and existing life cycle models to predict outcomes associated with different scenarios, including population growth, life history diversity and other metrics of viability. Both projects are examining management actions and science actions in an adaptive management framework that could advance learning through experimentation.

CSAMP also spent time in early 2022 discussing the roles and responsibilities of a Delta Smelt Program Manager whose responsibilities would include focusing on Delta Smelt recovery and overseeing science and adaptive management related to recovery.

The following describes the progress made over the past two years on projects related to Objective 3. For each project we provide a brief description of status, a description of products produced and a discussion of associated outcomes.

4.3.1 Delta Smelt Structured Decision Making (SDM) (expected *to be completed in 2024*)

Description and Status – CSAMP initiated 3-phased SDM focused on Delta Smelt recover in 2020 under the direction of Compass Resource Management. The process involved explicit articulation of hypotheses regarding factors affecting each life stage, and identification of potential actions that could address population bottlenecks. Activities in 2022 and 2023 focused on identifying actions, and portfolios of actions, and modeling the expected population impacts of those actions. Time was also spent in 2023 conducting sensitivity analyses and examining uncertainty and the technical feasibility of various actions. CSAMP is currently wrapping up Phase 3 of the Delta Smelt SDM process.

Products – Numerous products were produced in 2022 and 2023, largely focused on documenting progress of the SDM Technical Working Group (TWG) and engaging CSAMP Policy Group members. These products included:

- Slide presentations and materials for CSAMP Delta Smelt SDM Policy Steering Committee meetings; CSAMP Policy Group meetings in January 2022, October 2022, June 2023 and December 2023; CAMT; and the Technical Working Group (TWG).
- January 20, 2022 memo on the development of portfolios;
- May 30, 2023 memo summarizing the Round 1 SDM evaluation;
- July 11, 2023 proposal for next steps in response to input received at the June 2023 Policy Group meeting;
- September 7, 2023 memo regarding sensitivity analyses; and
- December 1, 2023 Policy Group update memo.

Copies of the above noted memos are included in Appendix B for reference.

Outcomes – The Delta Smelt SDM process represents the most comprehensive effort undertaken to date to examine bottlenecks to the Delta Smelt population and management actions that could address these bottlenecks and grow the population.

The effort employed several existing life cycle models to test various hypotheses and predict the potential outcomes of different management actions, and different combinations of actions (i.e. portfolios). The process has been robust, transparent and engaging, both at a technical level and a policy level. Consequence tables have been developed which compare the trade-offs associated with different actions and portfolios, including costs and benefits. Key findings from the Round 1 evaluation include:

- Current management (approximated in Portfolio 1b) is not sufficient to achieve Delta Smelt population growth in the long-term in the absence of consecutive wet years.
- Recovery is possible through multiple, additional actions with synergistic effects; there's no silver bullet.
- Actions and portfolios that improved food and turbidity showed greatest benefits to Delta Smelt across models.
- Strategically increasing flow could grow the population in the near-term.
- Portfolios that showed greater benefits to Delta Smelt included actions that have substantial financial costs and feasibility challenges.
- Exploring more portfolios could inform how to combine types of actions (flow, food, turbidity) and balance financial costs, water resources, and feasibility concerns.

All work performed to date is currently being documented in a detailed technical report. A high-level summary is also currently being drafted for management and policy audiences.

4.3.2 Salmonids - Reorienting to Recovery (*transferred*)

Description and Status – The "Reorienting to Recovery" salmon project stems from an NGO proposal to shift CSAMP's focus to broad-sense recovery of the species. The project (funded by the Delta Science Program, USBR, Water Foundation, and State Water Contractors) seeks to engage CSAMP member agencies, regional associations, interested parties, and California Tribes across the salmonid landscape in an inclusive, collaborative, and structured process to:

- Identify a suite of implementable and impactful actions that will advance the recovery of the four distinct runs of California Central Valley (CV) salmon (spring-run, fall-run, late fall-run, and winter-run) and steelhead throughout their life cycle; and
- Establish broad support and buy-in for these preferred actions by making trade-offs transparent and balancing participants' diverse values, perspectives, and priorities.

The project consists of three phases aimed at ultimately identifying a suite of actions that will achieve recovery:

- Phase 1: Define Salmon Recovery (Q2 - Q4 2021) - Engage Scientists to define salmonid recovery in biological terms.

- Phase 2: Engagement (Q1 2022 - Q3 2022) - Solicit input from state and federal agencies, public water agencies, non-governmental organizations, Tribes, and other interested parties throughout the Central Valley (CV).
- Phase 3: Decision Support (Q4 2022 – Q3 2024) - Structured Decision Making (SDM) process to identify, model and evaluate portfolios of actions.

Products – Phases 2 and 3 are complete and Phase 3 is currently underway. Products to date include a catalog of existing Central Valley recovery projects, a Phase 1 Report that outlines a recovery definition framework, numerous project and meeting materials (e.g., website, FAQ, one-pager, pre-read packets, etc) and revisions to the SIT model.

Outcomes – The intended outcome is support for a portfolio (or potentially portfolios) of actions that lead to recovery of the species while minimizing negative impacts.

4.3.3 Delta Smelt Program Manager *(paused)*

Description and Status – In 2020, CDFW provided a partial staff position to track Delta Smelt management actions and science, as recommended in CSAMP's 2019 Delta Smelt Science Plan. The staff position was reassigned to drought management in 2021. In early 2022 CAMT discussed the value of a full-time Program Manager to facilitate interagency coordination and implementation of actions identified through the Delta Smelt SDM process.

Products – CAMT produced a draft document outlining the roles and responsibilities of a potential position and options for filling the position, including creating an agency staff position and contracting for the position (see Appendix C). The document was never finalized.

Outcomes – In early 2022, there was not strong support for creating a new position, and the SDM process was in progress, so the initiative was paused.

4.4 Discussing Metrics and Monitoring

In late 2021, CSAMP initiated a Monitoring Assessment to improve understanding of monitoring activities in the Delta and to address CSAMP Objective 4 and Priority 3. This work continued into the first and second quarters of 2022 and resulted in two CSAMP reports, as described below.

The Monitoring Assessment included three specific tasks:

- Task 1 looked at what can be learned from past and ongoing monitoring reviews;
- Task 2 documented the objectives and perspectives of CSAMP members regarding monitoring; and
- Task 3 examined potential improvements to the monitoring enterprise.

Tasks 1 and 2 were completed in 2022 (see Appendix D and E). CSAMP discussions regarding Task 3 occurred in the third and fourth quarters of 2022, but were paused at the end of 2022 to allow PWA members to develop a more specific proposal for discussion. The PWAs shared updates with the Policy Group and CAMT in March, June and September 2023. The work of the PWAs, which focuses on developing a framework for improving the monitoring enterprise based on an

evaluation of management needs, is continuing to be refined, and is expected to come back to CSAMP for further discussion in 2024.

Findings from the Task 1 were documented in a report released in January 2022 and were discussed at length with the Policy Group in July 2022. The July 2022 discussion included engagement with the authors of previous reviews, including members of the Delta Independent Science Board who had finalized their *Monitoring Enterprise Review* earlier in the year.

The Task 1 Report identified ingredients for successful reviews and a number of lessons learned from previous monitoring reviews that could help improve future reviews, including:

- The enterprise could benefit from a "cultural change" that would embrace, and enable regular evaluation and maintenance of monitoring programs to preserve a long-term environmental record and meet evolving management needs.
- Reviews require significant time and should be iterative. To support continued management of long-term monitoring programs, dedicated capacity (i.e., statisticians, senior scientists) must be identified.
- Both internal and external scientists bring value to review efforts; both should be used strategically in a hybrid fashion.
- Public, accessible, and peer-reviewed publications as products of review efforts provide a way for the recommendations to be referenced and memorialized.
- Centering review metrics around the biological or ecological metrics that are linked to management questions positions changes to monitoring programs to be "timeless" and appropriate for a wide breadth of data uses.

Task 2 of the CSAMP Monitoring Assessment involved holding a workshop with CSAMP members in March 2022 and conducting a survey of CSAMP members. A summary of findings from Task 2 was released in September 2022 and discussed with the Policy Group in October 2022.

CSAMP member perspectives regarding the existing monitoring enterprise, as summarized in the Task 2 report, include the following:

- The existing monitoring programs are providing valuable information, but there are gaps in information and opportunities to improve the accuracy and utility of the data provided.
- More information on gear efficiencies, examination of littoral habitats and additional monitoring techniques would improve the quality and utility of the data provided, and could improve the accuracy of life cycle models and other predictive tools.
- The Delta environment is changing rapidly with climate change, sea level rise and invasive species, particularly aquatic weeds, and that the monitoring programs should be flexible enough to address such changes.
- Additional supplemental data may be needed to fully assess the effectiveness of specific management actions, depending on their objectives. Management actions frequently operate short time steps (hourly or daily) and/or require finer spatial scales to understand the outcomes of the actions. Relying on data from long-term status and trends surveys may not be sufficient on its own to assess the effectiveness of specific management actions.

In addition to the CSAMP Monitoring Assessment described above, CSAMP received regular updates in 2022 and 2023 regarding the ongoing 6 Agency Redesign effort which is examining potential improvements to several pelagic fish surveys in the Delta.

5.0 CSAMP Interviews

The following summarizes results from interviews with members of the Collaborative Science and Adaptive Management Program (CSAMP) conducted in February and March of 2024. A total of 12 interviews were conducted with CSAMP representatives from the following member agencies:

- Contra Costa Water District
- California Department of Fish and Wildlife
- California Department of Water Resources
- Delta Stewardship Council and Interagency Ecological Program
- Non-Governmental Organizations (Bay Institute, Defenders of Wildlife, Trout Unlimited)
- NOAA National Marine Fisheries Services
- South of Delta Water Contractors (State Water Contractors, Metropolitan Water District of Southern California, Valley Water, San Luis Delta Mendota Water Authority, Friant Water Authority) and the Coalition for a Sustainable Delta
- Sacramento Settlement Contractors (Tehama-Colusa Canal Authority)
- State Water Resources Control Board
- U.S. Bureau of Reclamation
- U.S. Fish and Wildlife Service

The interviews included Policy Group representatives, CAMT representatives and technical staff engaged in CSAMP activities. The interviews were designed for CSAMP members to provide their thoughts regarding the benefits, challenges, and priorities of CSAMP, as well as suggestions for potential changes. Members were given a set of questions to consider beforehand (see attachment) and were also given an opportunity to provide anonymous feedback using SurveyMonkey. Responses and results of the interviews are summarized below.

5.1 Summary of Findings

The main benefits of CSAMP were described as having a credible space where diverse stakeholders can share information, have challenging conversations, advance shared priorities, and build relationships. The top priorities identified by CSAMP members included recovery planning, the structured decision-making process (SDM), adaptive management and improving the science-policy dialogue. There were varied opinions about the priority of working on improvements to monitoring, and how to approach this effort.

While there was general agreement on CSAMP's value to the policy dialogue, there were a number of potential changes suggested including:

- Undertaking a deliberate "pause" while current active regulatory processes reach important milestones, to then develop a new iteration of CSAMP that productively contributes to the new regulatory landscape
- Exploring how to increase engagement, effectiveness, and impact, including expanding membership of CSAMP (e.g. to Tribes)
- Minimizing duplication of effort with closely connected initiatives.
- Improving the value that CSAMP products provide for decision-makers, including better informing policies relevant to regulations and recovery (though there were different opinions on how to achieve this).

5.2 Benefits and Outcomes

All CSAMP members shared a common sentiment that CSAMP allows diverse stakeholders to share information, understand one another's perspectives, learn from each other, and have meaningful conversations. One member shared that CSAMP is a "*safe place for hard conversations*". Members also shared that it is the only forum where state and federal agencies, NGOs and PWAs, are at the same table to find common ground and advance shared goals and priorities. Members shared that the forum has built and strengthened relationships and trust over time, and that the impacts of this are invaluable.

CSAMP members described CSAMP products as professional resources that summarize the current state of knowledge and advance a common understanding of issues and activities among diverse organizations. Members also shared that CSAMP has helped to inform and narrow management options in some cases. Where CSAMP products reflect a consensus among different interests, they carry a special weight. The following efforts and products were described as among key accomplishments:

- Delta Smelt & Salmon Science Plans
- Delta Smelt Structured Decision-Making (SDM)
- Salmonids-Reorienting to Recovery
- Adult Delta Smelt Entrainment & OMR Management
- Winter-Run Life Cycle Model Stakeholder Forum

5.3 Challenges

Several CSAMP members, particularly State and Federal resource agency members, expressed concerns regarding their capacity to engage in, and support CSAMP activities. Current regulatory activities such as reconsultation on the Long-Term Operation (LTO) of the state and federal water projects and development of an update to the State Water Quality Control Plan are requiring significant staff time, which is affecting the ability to staff CSAMP activities.

Several CSAMP members also noted a decline in participation in CSAMP, particularly at the policy level. This is likely due in part to the capacity issue noted above, but may also be symptomatic of other issues.

A number of long-standing CSAMP representatives, both on the Policy Group and on CAMT retired over the past two years. This has contributed to the participation issue, but has also affected institutional knowledge and leadership.

One of the other challenges that surfaced during the interviews was the ongoing tension around the nature and degree of involvement in regulatory issues. The importance of developing and distributing information that could be used to inform policies, including regulatory policies, was a common theme. Some members favored directly addressing regulatory issues such as evaluating the effectiveness of specific regulations, while others suggested that CSAMP might be best suited to focus on longer-term recovery issues in the "non-regulatory" space.

5.4 Priorities

CSAMP's existing 2022-2024 priorities are listed below. CSAMP members were asked to provide input on these priorities to guide the next three years of CSAMP work. Generally, CSAMP members agreed

with these priorities and did not suggest alternatives. There were various suggestions about how to approach these priorities to increase effectiveness and impact.

1. *Facilitate Recovery Planning & Adaptive Management*
   The Delta Smelt SDM process and Re-orienting to recovery were commonly cited as appropriate CSAMP efforts in this realm. Members expressed a desire to continue working on, and conclude both. For Reorienting to Recovery, proposed next steps included optimizing the process with modeling, and broadening engagement. Many CSAMP members expressed the importance of translating CSAMP's recovery work into implementation, management, and direct actions to improve the chances of species recovery, but specific means of accomplishing that were not proposed.

2. *Improve Science-Policy Dialogue*
   Overall, there was universal recognition of CSAMP's important role in broadening the Science-Policy dialogue. One organization called the Science-Policy Dialogue effort, the "*foundational bread and butter of CSAMP*." Most CSAMP members see this effort as an opportunity to expose policy makers, or their representatives, to activities and studies across entities (e.g. Delta Smelt supplementation, salmon survival in the Delta, Delta Smelt modeling). Members noted that CSAMP products (e.g. entrainment paper, salmon gap analysis) have been beneficial to dialogue in other venues.

3. *Advance Improvements in Monitoring*
   Overall, there was varied interest in CSAMP continuing to pursue this priority due to uncertainty about how to approach it, unknowns of similar efforts, and concerns about impact and funding. CSAMP members expressed a range of opinions about next steps. Some members suggested that other organizations and efforts are more appropriate to tackle improvements in monitoring, particularly around technology and monitoring techniques. Other suggestions included:
   - Limiting the focus to key questions, goals and metrics associated with monitoring;
   - Better understanding the monitoring landscape and how the various efforts talk to each other in order to identify a clear potential role for CSAMP; or
   - Keeping monitoring a priority but making it a lower priority and committing fewer resources.

5.5 Potential Changes

There were various recommendations and potential changes to CSAMP suggested during the interviews. Many CSAMP members shared similar sentiments but differed on details as to how to achieve those. Suggestions tended to focus on the overall direction of CSAMP, and its overall effectiveness, impact and engagement.

Overall, most CSAMP members expressed an interest in CSAMP exploring how to:

- Evolve to the current regulatory and monitoring landscape.
- Clearly identify where and how CSAMP can be most useful.
- Broaden reach and engagement.
- Increase impact, especially around decision-making.

- Create a renewed sense of collaboration and commitment.

Several CSAMP members suggested that the overall direction and focus of CSAMP be reassessed. There were suggestions to assess the organizational structure, as well as its relationship to other forums to determine the most appropriate and effective role for CSAMP. One CSAMP member said, "*there's a need for something that stitches all the processes together that is not designed to replace or supplement them, but to connect and empower them*."

Many members shared a desire to not be duplicative, but yet connect more to current processes (BDP, LTO, 5-yr Status Reports, ITP, Water Quality Control Plan). Several members recommended that CSAMP consider how to adapt to the evolving regulatory landscape and associated capacity issues.

Other recommendations from CSAMP members included:

- Undertaking a deliberate "pause" while current active regulatory processes reach important milestones, to then develop a new iteration of CSAMP that productively contributes to the new regulatory landscape
- Expanding the membership of CSAMP to include more environmental groups, the fishing community, Tribes and academia.
- Addressing and resolving interests and concerns regarding a possible role for CSAMP in implementation of the Voluntary Agreements (VA).
- Increasing the reach and utility of CSAMP's products, including finding the appropriate venues to share the products, such as through published papers. One CSAMP organization described CSAMP's products as "*extraordinary and incredible resources that are vastly underappreciated and underutilized*". Another organization described the need to "*catalyze the science and reap the benefits of collaboration*."
- Identifying the gap between CSAMP outputs and adoption/buy-in and impacts on key decision-making processes.
- Creating more timely and applicable products with more "teeth" that can be communicated effectively and directly synced to specific decisions, actions, and regulatory initiatives.
- Focusing on disagreements between CSAMP members early on to understand tension points rather than focusing on areas of agreement, which some members identified as a constraining and limiting factor.
- Continuing to find common ground and collaborate. One CSAMP member said, "*when we stop talking, that's when we get into trouble*".