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"Changing Demands and Water Supply Uncertainty in California."
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INTRODUCTION

Mr. Chairman, Ranking Member Huffman and Members of the Subcommittee, my name is Ara Azhderian, Water Policy Administrator for the San Luis & Delta-Mendota Water Authority (Authority). Thank you for the opportunity to appear before you today to testify on the causes of uncertainty affecting the water supply of the 8th largest economy in the world, the State of California.

The San Luis & Delta-Mendota Water Authority (Authority) is a Joint Powers Authority under California law that was formed in 1992. The Authority serves 29 member agencies, 27 of which hold contracts for water with the United States Department of Interior Bureau of Reclamation's (Reclamation) Central Valley Project (CVP). Our members manage water to serve agricultural, municipal, and environmental purposes. Our service area is approximately 3,300 square miles and spans all or parts of 8 counties: Contra Costa, Santa Clara, San Joaquin, Stanislaus, Merced, San Benito, Fresno, and Kings. Roughly, our northern border is the southern edge of the Sacramento-San Joaquin Rivers Delta (Delta), our eastern border is the San Joaquin River, our southern border is California State Highway 41, and our western border is the Santa Cruz Mountains. Our members provide water to 5 of the nation's top 10 agricultural producing counties, to the second largest contiguous wetlands in the United States after the Florida Everglades, and to approximately 2 million Californians living in communities ranging from small, rural, often disadvantaged towns like Avenal and Huron, to the affluent global center of technology, Silicon Valley. If you have eaten a cantaloupe, used a can of tomato sauce or jar of salsa, "googled" on an iPhone, or just appreciate the majesty of birds migrating the Pacific Flyway, the chances are good that you've been touched by CVP water.

BACKGROUND

Since formation of the Authority, drought has been the center of our universe. In 1992, California was in the 5th year of a natural drought, a hydrologic situation not dissimilar from today. In the worst of it, CVP agricultural water service (Ag Service) contractors were allocated 25% of their contract supply. Concurrently with the natural drought, regulatory changes were happening in rapid succession, first with the listings of winter-run salmon and delta smelt under the federal Endangered Species Act, the reprioritization of CVP water supplies under the Central Valley Project Improvement Act, and new water quality standards under California's delegated Clean Water Act authority. The water supply reductions resultant of the natural drought made it difficult to comprehend what the water supply impacts of the regulatory drought would be once the rains returned. As the dust settled over the next few years, it became clear that the regulatory drought had reduced the CVP water supply for south of Delta Ag Service contractors by about 35% on average. Many small farms vanished, many acres were constantly fallowed, many jobs were lost, and several once vibrant agricultural communities became shells of their former selves.

In response, farmers did what they do best, adapt. The new regulatory water supply gap would be expensive to close, so farmers started planting higher value crops. With the increased revenue, they began investing in state-of-the-art irrigation systems, reusing and recycling drain water, and purchasing water for transfer, a big portion of which came from northern California. By the late 1990's, as some stability returned, efforts turned towards restoring the water supply lost to the regulatory drought. The center of this effort was known as CALFED, an enterprise aimed at improving both the environment and

water supply. However, despite billions of dollars spent and millions of acre-feet dedicated to the cause, by the mid 2000's new, startling fish abundance declines were underway, affecting delta smelt and winter-run salmon, among others. With respect to delta smelt, the Interagency Ecological Program Pelagic Organism Decline Progress Report: 2007 Synthesis of Results identified numerous possible causes for the decline, including contaminants, predation, and lack of food, and stated, "Entrainment at the CVP and SWP pumps also seems to be an unlikely single cause of POD but may be important in some years for some species." Regarding salmon, both the National Marine Fisheries Service (NMFS) and Pacific Fishery Management Council concluded that the sudden decline was caused by poor ocean conditions. PFMC stated in their March 2009 report "What caused the Sacramento River fall Chinook stock collapse?" that "The evidence pointed to ocean conditions as the proximate cause because conditions in freshwater were not unusual, and a measure of abundance at the entrance to the [Bay-Delta] estuary showed that, up until that point, these broods were at or near normal levels of abundance." Yet, despite numerous scientific reports identifying multiple causes driving the new fish declines, the United States Fish and Wildlife Service (FWS) and National Marine Fisheries Service (NMFS) chose to do what they have always done, implement single stressor, single species regulations, primarily on the CVP and California State Water Project (SWP) (collectively Projects), while doing little to address the myriad of other known stressors.

In 2008 and 2009, the FWS and NMFS issued new biological opinions (BiOp), the primary focus of which is to curtail pumping. While the BiOps do call for other actions, like habitat restoration, no action has been as vigorously implemented as the pumping constraints. Like the regulations implemented in the early 1990's, these too were implemented during a natural drought period so the "real world" water supply costs have been difficult to determine. Water operations modeling suggests that the BiOps have cut CVP and SWP water supplies by about another 30 percentage points. For south of Delta Ag Service contractors, this translates to a long-term average water supply of about 35% of contract. The current BiOps have squeezed virtually all of the operational flexibility from the Projects, causing the damaging effects of the natural drought to amplify the chronic water supply shortages of the regulatory drought, with devastating effect throughout the CVP service area, but especially in the San Joaquin Valley. Over the last 4 years, CVP south of Delta Ag Service water supply allocations have been 20%, 0%, 0%, and 5%. In 2014, for the first time in the history of the CVP, Reclamation had to draw CVP water from the Eastside of the San Joaquin Valley for delivery to the Westside, and to borrow water from individual farmers and districts, because it could not meet its contractual and statutory obligations to provide water to prior water rights holders and managed wetlands from traditional sources of supply in the north. In addition, over 2 million acres of farmland received no CVP water whatsoever and CVP supplies to municipalities were approximately 30% of historical average, significantly lower than the minimum called for in Reclamation's Municipal & Industrial Shortage Policy. These disasters were repeated in 2015.

Since imposition of the BiOps, federal agencies have steadfastly claimed that the unprecedented water supply shortages that have followed have been the result of the natural drought, not a regulatory drought. As recently as February 24 before this very Subcommittee, Reclamation's Mid-Pacific Region's Director David Murillo reiterated, "While some have argued the state's water supply cutbacks are entirely due to environmental regulations, *it has been drought – the extreme declines in annual precipitation and snowpack in California since 2012 – far more than any other factor* [emphasis added], that has constrained the ability of the state and federal projects to deliver full allocations of water

during these years." Clearly natural drought plays a role in water supply, this has always been the case and is a major reason why the Projects were built, but a review of the volume of water stored in Shasta Reservoir [Attachment 1] clearly demonstrates that it is how the water is used that affects water supply allocations, much more than how much there is of it. The red line represents 1977, the benchmark dry year, the blue line represents 1991, the fourth year of that 5 year drought cycle, the green line represents 2015, the fourth year of our most recent drought cycle, and the heavy blue line represents this year. The corresponding CVP south of Delta Ag Service water supply allocations for these 4 example years are 25%, 25%, 0%, and 5%. And it is not just the volume of water in storage that has been affected, but too our ability to capture water at critical times. Attachment 2 illustrates all of the missed opportunities this year to pump water when it was abundant in the Delta. The color coded background indicates what regulation was generally causing the restriction over some period of time. The dashed, variable line indicates the volume of uncontrollable water flowing through the Delta and into the Pacific Ocean. The comparatively static, solid line indicates combined CVP and SWP pumping. The effect of the BiOps pumping restrictions are plain to see – the ability to pump water south is now essentially divorced from the volume of water available in the north. The result of this disconnect is illustrated in Attachment 3. The blue bars compare the volume of water that flowed into the Pacific in 2015 and 2016. The red bars compare the volume of water pumped in the same timeframe. Despite there being 350% more water flowing through the Delta this year, the Projects were allowed to only capture 50% more than last year. It is undeniable that regulation is the significant driver behind chronic water supply shortages; natural drought just exacerbates the already bad situation.

By any measure, 2016 will be a historic year, and likely turning point, for the Projects. For 4 years now we, all of us, have been told that when the rains return to California, so will the water. But that has not happened. Looking forward, it seems unlikely that the decades-long decline in delta smelt and winter-run salmon populations will suddenly, dramatically, and sustainably reverse absent new management approaches. If that is so, what are the implications for California, the 8th largest economy in the world and producer of about 50% of the nation's fruits, nuts, and vegetables? What are the implications to the financial investment Congress and other have made in the CVP? And what are the implications to the cultural, socio-economic, and environmental conditions of the people once encouraged to settle and develop communities in the Central Valley, a population roughly the size of the State of Colorado?

We are at a critical juncture. Our agricultural and municipal water users have continually adapted to the ever increasing regulatory demands, becoming among the most efficient users of water in the world. However, continued gains through conservation, reuse, and recycling are not limitless, are extremely costly, and in some cases economically infeasible. The myopic attention on flows over the past quarter century have contributed mightily to the terrible status of several species today. Regulators have too readily seized upon flows in part because it is an easy, tangible, "feel good" change to make. And while virtually every drop of water used for agricultural and municipal purposes must be accounted for, the fastest growing segment of water demand, environmental management, has no such requirement for accountability. Moreover, the prevalent single stressor, single species approach imposed by FWS and NMFS ignores the consistent and pervasive scientific advice that multiple stressors are work therefore comprehensive solutions are necessary if we are to be successful. As an example, habitat restoration has long been identified as an important part of the solution, but progress has been inexcusably slow given the decades listed fish populations have been under stress. Ultimately, better

solutions will require better approaches, science, and decision making processes to ensure that we are not the first generation of resource managers that leave both environmental and water supply conditions worse for the next generation. The time is now, the choice is ours and, for many of us, the choice is obvious.

WATER SUPPLY UNCERTAINTY DUE TO DELTA SMELT MANAGEMENT

POPULATION

Delta smelt population indices are at an all-time low, which is a natural cause for concern and the primary driver of fears regarding the potential for extinction. However, while the population indices do tell us about the general trend in delta smelt abundance, they do not provide us an accurate estimate of actual population. There are several reasons for this. First, the monitoring methods used to measure delta smelt numbers and distribution are inefficient. A boat can trawl the open water looking for delta smelt and catch a few or none while feet away, individuals sampling the shore with nets can catch tens, even hundreds, at essentially the same location. Also, delta smelt are known to reside in regions, such as Cache Slough and the Sacramento Ship Channel, that are not counted in the historical population indices or recent FWS population estimates. In other words, the numbers reflected by both are known to be artificially low. Further, these regions not only routinely harbor significant numbers of delta smelt but, such as with Cache Slough, also some of the healthiest. While for years there has been broad agreement that the current monitoring practices are inefficient and in need of modernization, change has been inexcusably slow.

Extinction concerns should be further moderated by two other considerations. First, work completed earlier this year by U.C. Davis used genetics based measures to assess the effective population size of delta smelt. The findings are promising and demonstrate that the effective population size of delta smelt as of the 2014 year class is above the threshold where fitness related genetic diversity is expected to be lost. The implication of the genetic diversity and the effective population size information is that a large number of Delta Smelt remain in the San Francisco Estuary system. However, the current disparity between FWS delta smelt abundance indices and the effective population size is a concern as it may indicate existing monitoring programs will have difficulty adequately representing delta smelt abundance, distribution or habitat needs. Second, there are two delta smelt conservation hatcheries, the U.C. Davis Fish Conservation and Culture Laboratory (FCCL) in Byron, California and the U.S. Fish and Wildlife Service's Livingston Stone National Fish Hatchery located at the base of Shasta Dam near Shasta Lake City, California. These facilities exist to raise delta smelt as a back-up or "refuge" population to insure against extinction. These delta smelt also represent an untapped resource, as they could be used to conduct field research to improve our very limited understanding of suitable delta smelt habitat and/or as brood stock to assist in the recovery of the wild population. Unfortunately, current FWS policy prohibits use of these fish beyond the hatchery, so for the vast majority, they are simply reared to be discarded at the end of their one year life span. We should be able to do better with our multi-million dollar annual investment.

INCIDENTAL TAKE LEVEL AND 2016 WINTER OPERATIONS

Generally, an Incidental Take Level is the number of a listed species that a regulatory agency anticipates will be taken by the normal, permitted activity of an action agency. For 2016, the FWS calculated an ITL of 56 adult Delta smelt and 392 juveniles for the combined CVP and SWP pumping

operations, which supplies water to roughly 2 out of 3 Californians. How the ITL is both calculated and managed raises significant concerns. First, the ITL is unreasonably low. This is in part due to its reliance on the artificially low abundance index numbers. But, it is also because the most recent formula developed and implemented by FWS this year excludes a significant portion of the historical take data largely related to average water-year types. Essentially, the center of the take bell curve was ignored. What remains are the extremes, either really dry years when pumping and turbidity are low anyway, or very wet years when OMR's reverse flow is low because of high San Joaquin River inflow. Under either condition, historical take is generally low. So, by only including outlying years with historically low take, the current ITL formula produces a number much lower than what would reasonably be expected under normal pumping operations. Whether this approach was an explicit policy choice, or a de facto one resulting from choices made by those who created the formula, is unclear. What is clear is that it is not a science issue, and, if left unresolved, will continue to artificially constrain California's water supply, potentially for years to come.

The second, and perhaps more significant, concern with the ITL is its psychological effect. With the adult abundance index at an all-time low, and an all-time low ITL, the handful of biologists making day-to-day operational decisions have begun viewing the ITL as a number to avoid rather than one to be expected, as demonstrated in Smelt Working Group notes stating that 0 salvage should be considered a requisite to increased pumping. Under normal conditions, an ITL will be exceeded periodically and the process thereafter is to reconsult, which has happened with adult DS in the past. Under today's conditions, the fear of reconsultation is great, in part because the fear of extinction is overblown. When the Projects asked FWS what would happen *this* year if the ITL of 56 fish was exceeded, the answer was that OMR, and therefore pumping, would likely be constrained to the bare minimum of -1,250 cfs for the remainder of the adult spawning period, perhaps months. The apprehension that results prompts the CVP and SWP operators to take actions to not just minimize, but avoid, their otherwise lawful, permitted level of take. The resultant water supply cost due to lost pumping between January and March 2016, was approximately 820,000 acre-feet (Attachment 4) with no demonstrable benefit to delta smelt abundance. That is enough water to serve about 1.6 million households for a year, to farm approximately 270,000 acres of crops, and to produce billions dollars of economic activity. In the end, the resultant socio-economic harm is a policy choice, not a scientific question, and yet for the most part, the harmful results stem from the unchecked opinions of a few state and federal biologists.

If the purpose of a BiOp is to avoid jeopardy and adverse modification of critical habitat, what information has the FWS developed to demonstrate the operational constraints imposed upon CVP and SWP operations over the last 9 years are achieving those goals? Regrettably, there is none and, rather than that fact leading to a wholesale reevaluation of how and what is being done to protect and recover Delta smelt, the FWS is proposing a more of the same strategy. The mantra today has become every fish matters but, only if they *may* be affected by the Projects. In the meantime, the FWS continues to do little to address the multitude of other stressors that independent scientists have been telling us for decades, ignore at your own peril. Delta smelt were listed nearly 25 years ago, what has FWS done to address other stressors? What other BiOps, ITLs, permits, and restrictions has FWS imposed on activities beyond the Projects? What explains the willingness of FWS to take, in a single day, at a single location, the number of adult delta smelt equivalent to the total allowed the Projects for the entire year? The response would likely be concern about entrainment in the south Delta in general, not just salvage. But, what evidence demonstrated this was occurring? The January through March Spring

Kodiak Trawl data clearly demonstrates that the vast proportion of delta smelt were along the Sacramento River between Suisun Marsh and the Sacramento Ship Channel (Attachment 4), far to the north, consistent with historical distribution. The Smelt Working Group's biologists' response is that lack of delta smelt in the monitoring data is not evidence of their absence, and that may be, but it certainly says something about the relative proportion at risk and the disproportionate regulatory response to their protection.

Ultimately, what this years' experience demonstrates is how far we have veered from the use of best available science and the blurred distinction between science and policy choices. Multi-billion dollar decisions impacting millions of lives and numerous public policy initiatives are being made in isolation by a handful of individuals based upon conjecture and belief, not science. At what point does unbridled discretion become an abuse of authority? Or, is this the new normal for California and all that depend upon the CVP?

SUMMER FLOW ENHANCEMENT

In what can only be described as a Hail Mary, the FWS is proposing it's most desperate action yet, increasing summer outflow in the hope it may produce more delta smelt. Unfortunately, the proposal as described in various meetings – it is not yet documented – does not appear to be supported by the weight of scientific evidence. Our current understanding is that the FWS is pressing Reclamation to acquire between 80,000 and 115,000 acre-feet of water to augment Delta outflow in August and September of 2016, and between 200,000 and 300,000 acre-feet of additional outflow from July through September in 2017 and 2018. The intent is to move "X2", the location in the Delta where salinity is at 2 parts per thousand, further west in the hope that this new location will somehow benefit the population. The cost to move X2 is significant, both in terms of water and money. Recently, Reclamation identified the activities from which it would take $10,880,000 from existing projects, including from the Battle Creek Salmon and Steelhead Restoration Project, one of the largest cold-water anadromous fish restoration efforts in North America, and refuge water supplies, which are not only an already unmet statutory obligation, but a vital resource in the protection of migratory birds protected under Migratory Bird Treaty Act of 1918 as well as management of numerous other endangered species. Furthermore, while the FWS has been clear that this proposed action is outside the bounds of the BiOp, and therefore should be a non-reimbursable cost to the CVP, Reclamation has yet to insure that the costs that may be incurred will not be rebilled to CVP contractors.

In putting forth its proposal, FWS has not only ignored the best available science but also the Administration's commitment to transparency, participation, and collaboration. The published literature indicates that Delta Smelt abundance is unrelated to summer outflow, the location of X2, or the volume of low salinity habitat. It also suggests that delta smelt would not move from one location to another because of a change in the location of X2. And if they did, published field studies demonstrate they would likely leave superior habitat like that in the Cache Slough region of the Sacramento River, where most of them are currently located, for some of the poorest quality habitat, which is in Suisun Bay. In other words, the proposed flow augmentation could actually further harm delta smelt, though none of the potential adverse effects of this discretionary action have been analyzed. It is just assumed the benefits will outweigh the consequences. Rather than risking millions of dollars on this ill-conceived idea, the biological benefit of which will likely never be measured, we should

invest in research and actions that could yield tangible results, such as understanding the biological mechanisms driving delta smelt declines.

WATER SUPPLY UNCERTAINTY DUE TO WINTER-RUN MANAGEMENT

Nine months into the water year, CVP and SWP contractors finally have a salmon temperature management plan. However, while the plan allows for operations much closer to those originally approved by NMFS on March 31, 2016, it also contains a number of conditions and off-ramps that if triggered would rapidly result in decreased releases from Shasta Reservoir and potentially severe water supply disruptions throughout the Central Valley. In early May, Reclamation and NMFS learned that Shasta Reservoir was warmer than expected, thus NMFS informed Reclamation that the March 31 concurrence was no longer supportable and the effort to formulate a new plan was initiated. Over the course of nearly two months, NMFS, the California Department of Fish and Wildlife, the State Water Resource Control Board, the California Department of Water Resources, and Reclamation worked diligently, and insularly, to produce another acceptable plan, which was finally approved on June 28, 2016. While agreement was welcomed, the process for developing the plan and disproportionate attention given to a single biological stressor is cause for great worry going forward.

Generally, the salmon life cycle has a number of important stages: the egg-to-fry stage, when they are most sensitive to temperature, the juvenile stage when they will attempt to migrate down the Sacramento River to rear in the Delta and ocean, the adult stage when they mature in the ocean for about 2 1/2 years, and finally the adult migration back home to spawn so that the cycle can begin all over again. At each step, there are a number of manageable factors that affect the survival of salmon. The Herculean temperature management planning effort focused thousands of staff hours, nearly a hundred model scenarios, and untold policy conversations to wrestle a decision about whether another nearly 400,000 acre-feet of water should be taken from water users to improve the predicted temperature related survival of winter-run salmon from 94% to 95%. All the while, relatively little was, or is, being done to address the estimated 75% predation related mortality that will occur as the juvenile salmon migrate downstream to the sea, or the near 20% harvest related mortality that will occur as a result of commercial and recreational fishing in the ocean. For the few that successfully survive the journey, other factors will affect their reproductive success, such as the quality and availability of suitable spawning gravel and habitat conditions in the river. Typically, only about 0.05% of the eggs laid in the river will survive to maturity at age 3 and successfully reproduce the next generation to complete their lifecycle. For 2016, the work done to develop the water temperature management plan predicts that temperature-related mortality for winter-run salmon to be 5 to 6%, which means over 94% of the expected mortality will be resulting from other causes.

Is temperature related survival a vital step in the salmon lifecycle? Of course, but it is not the only vital step; successful temperature management does not always translate into a high number of mature adults returning to spawn. The reality is, if we get survival at one life stage perfect, and ignore other sources of mortality, we fail. The fact that winter-run salmon stocks, along with other Central Valley salmon, have continued to decline so significantly over the past several decades is a clear and strong indicator that the current management approach of focusing disparately on only a few select stressors has not proven to be effective. So, while we should be concerned about the poor temperature related survival of the past two years, we should not be surprised by the overall low abundance of

winter-run salmon. Until we implement a comprehensive approach to their care, winter-run, along with other salmon, will continue to suffer.

While efforts are underway to establish more collaborative forums to assess the state of knowledge regarding Central Valley salmonids and to provide a basis for designing and implementing improved management actions, the pace is too slow and the level of federal effort disproportionate to the problem. Discussions among public water agencies, environmental and fisheries organizations, and state and federal agencies demonstrate a willingness and ability to collaborate on comprehensive solutions. These discussions have identified a diverse set of potential management actions, such as spawning gravel augmentation and habitat improvements, reducing predation, improving hatchery management, implementing a mark-select harvest program to reduce commercial and recreational fishing impacts to wild and listed salmon, improved methods for transporting and releasing salmon, among others. In 2014 and 2015, CVP contractors worked with Reclamation to make available a quarter billion dollars of water to augment temperature management potential. But to fully realize the potential of federal, state, and local government and private partnerships, NMFS must dedicate the resources necessary to help develop, and ultimately permit, these multi-stressor solutions.

RECOMMENDATIONS

We are upon another historic turning point in the management of listed species and the Projects. The choices made over the coming months will impact California, the nation, and beyond, probably for decades. On one hand, we can continue down the path established by the FWS and NMFS over a quarter century ago: single species, single stressor management, insular science and process void of experimentation, balance, or accountability, and failing to protect, much less recover, the species. Or, we can embark on a new path, one that is collaborative, transparent, comprehensive and far more likely to produce beneficial results for listed species and the people who both care for their protection yet depend upon the Projects' for an affordable, reliable, and sufficient water supply.

We understand that Interior and the California Department of Water Resources are currently working on a framework for furthering an array of short term actions aimed at helping smelt. This is helpful as it may bring some order to this very chaotic regulatory and operating environment. To inform this process and others needing guidance and oversight, we offer the following recommendations. It is not the aim of the San Luis & Delta-Mendota Water Authority to eliminate or undermine environmental protection. On the contrary, it is our interest to develop, implement, and support *effective* environmental protection.

NEED FOR TRANSPARENCY

On his first day in office, President Obama signed the Memorandum on Transparency and Open Government to express his Administration's commitment toward improving government openness, efficiency, and effectiveness through transparency, participation, and collaboration. Unfortunately, little of the potential of this commitment has been realized by the FWS and NMFS. The examples of concern above were born in insular processes followed by choice, not necessity. If public water agencies and the people we serve are to suffer the consequences of the regulations imposed upon them, they also deserve to know throughout the formulation process the need, scientific basis, policy tradeoffs, and anticipated outcomes of the proposed action. Sadly, this level of transparency, and the accountability that should accompany it, is not present today. This should change.

NEED FOR COLLABORATION

Despite their best efforts, the federal and state regulatory and resource agencies have not been able to adequately protect listed species nor provide sufficient water supply to millions of Californians. This reality is due to a number of factors: limited budgets, lack of resources, legal authorities, and capabilities, among them. In order to ensure better outcomes going forward, federal and state agencies should partner with public water agencies, and other entities, committed to and capable of expanding efforts to address the myriad of problems we face today. Public water agencies provide a unique, largely untapped, resource to help address the environmental and operational concerns affecting management of listed species and the Projects. Public water agencies hold a distinct position in California's water resource management chain, serving as intermediary between the federal and state agencies and as fiduciaries to the tax and rate payers that both fund and rely upon our collective services. Public water agencies also have specialized operational knowledge, modeling and scientific capabilities, a unique concern in the policies, practices, and outcomes of federal and state government actions, and extraordinary expertise and resources to bring to bear.

An example of an ongoing scientific and management oriented collaborative effort is the Collaborative Science and Adaptive Management Program, or CSAMP. It includes representatives from federal and state fish and wildlife and water supply agencies, public water agencies, and environmental organizations. While this forum was born from the litigation over the 2008 and 2009 FWS and NMFS biological opinions and was created to help address the most controversial science questions related to the BiOps in an inclusive and collaborative manner, it continues to work voluntarily today with the aim of minimizing divergent views and potential conflicts associated with the science used to inform future opinions. Over the last 3 years, the effort has identified key knowledge gaps and disagreements in our understanding of Central Valley salmonids and provided recommendations to resolve them, and has begun a series of analyses examining questions related to the impact of Project operations from entrainment and fall outflow on Delta smelt. While initial progress was slow, trust and a strong collegial work environment has emerged. Unfortunately, both recent processes to develop the FWS summer flow proposal and the NMFS reevaluation of the salmon temperature management plan chose to ignore the CSAMP collaborative approach; rather, employing the traditional insular method. Much of the controversy that exists today regarding these two proposals could have been minimized, and perhaps avoided, if a collaborative approach like CSAMP had been utilized from the outset. If the better outcomes we are all seeking are to be achieved, a better process to develop the science and management actions and evaluate their performance is necessary.

Related to collaboration is the attendant need to implement true adaptive management programs. While the BiOps talk about adaptive management, it is not effective adaptive management in that it provides no formal, structured path for ongoing stakeholder participation in the questioning and testing of hypotheses to refine or reject management actions based upon the scientific evidence. What is in place current has basically been used by the FWS and NMFS to impose stricter regulatory criteria or thresholds unilaterally, without any monitoring or assessment of the actions biological efficacy. As with investing, we should not adopt a set it and forget it approach to environmental management.

NEED TO UNDERSTAND CAUSE AND EFFECT

For decades now, numerous independent scientists and peer review panels have cautioned against too much reliance upon statistical correlations and have recommended we focus instead on

researching cause and effect relationships. Correlations can be misleading because they do not always reflect the actual cause-and-effect relationships or the underlying mechanisms. Absent causal information, it is difficult to predict how changes in an environmental variable can effect changes in the population of a species. By better understanding the biological mechanisms at work, we will develop management actions that are both more efficient and effective. Yet, despite overwhelming agreement to the contrary, the FWS yet again proposes a management action based upon a very weak statistical relationship. The current FWS proposal to augment summer Delta outflow hinges on the idea that delta smelt abundance is somehow linked to the location of X2 (the location in the Delta where salinity is at 2 ppt) in the western Delta. X2 is the posterchild of the cause and effect warning.

From its very onset in 1996, the "so-called "fish-X2" relationships", as it used to be referred to, was recognized as being a "rather crude management tool" by the Interagency Ecological Program, which stated, "More precise influence on these species in terms of quantity or timing of outflow would be desirable for efficient management. In addition, the potential influence of alternative or complementary management actions is difficult to determine from these [statistical] relationships". The US Geological Survey offered similar caution observing, "Significant scientific uncertainty remains, however, about the specific linkages between salinity [i.e. X2] and fish species abundance and about how the aquatic ecosystem within the Delta and Suisun Bay might respond to changes in water flow management. Information is also needed about the relationships between river flow and… the effects of contaminants both in the water, and associated with suspended and bottom sediments [i.e. causal mechanisms]." In 2006, an independent science review panel report examining the then occurring Pelagic Organism Decline remarked, "More generally, in using historical data to infer the effect of an environmental variable on a biological population, it is important to go beyond simply attempting to establish a correlation between the environmental variable and abundance. Instead, inference should be based on an understanding of the direct effect of the environmental variable on population dynamics (e.g., on one or more vital rates) and how this direct effect would be reflected in abundance." And again, just months ago speaking before the State Water Resources Control Board, Lead Scientist of the Delta Science Program, Dr. Cliff Dahm stated when summarizing key take home messages from the "Flows and Fishes in the Sacramento-San Joaquin Delta" report, "The first one is that moving forward, we really need to focus more on cause and effect relationships, not just correlations, because correlations can sometimes be spurious."

For more than 20 years, scientists working on Bay-Delta fishery issues have overly relied upon statistical correlations to establish environmental management regulations, and after 20 years, billions of dollars spent, millions of acre-feet dedicated, and untold socio-economic disruption, the species we have sacrificed so much for are in worse shape than ever. We cannot roll back the clock and recover 20 years of lost research opportunity, but we also do not need to spend another 20 years following the same failed path. Rather than spend the tens of millions of dollars necessary to purchase water for the FWS summer X2 outflow action, the effects of which we will likely never be able to determine, we should invest in research that will bring about tangible results, actionable information, and much needed efficacy towards advancing species management.

<u>NEED TO EXPERIMENT</u>

Many of the regulations steadfastly in place today began as simply hypotheses – just ideas really, many without much scientific foundation or certainty. As originally written by scientists, these

hypotheses usually contain copious caveats with words like “may” and “should”, error bands, confidence intervals, and recommended actions to test the hypothesis so that it may be refined or rejected based upon the empirical information. This process is generally referred to as the “scientific method” and it has served us well for hundreds, if not thousands of years. Enter the regulators. Well intended as they may be, their job is to build boxes. Boxes do not have windows or doors; the walls are rigid and boundaries certain. Into these boxes regulators place the hypotheses, but since the hypotheses are flexible by definition, they must be changed, specific thresholds selected, appropriate caveats replaced with words like “will” and “shall”, and the scientific method as an ongoing process is supplanted by the process of regulatory policy choices. If the policy choices are controversial, regulators often defend them by presenting false choices and certainty. For example, under the FWS BiOp we are told that the Projects’ pumping operations jeopardize delta smelt, therefore restrictions on OMR must be established and Projects’ pumping cannot exceed a specified rate. There is no evidence that entrainment of delta smelt by the Projects has a population level effect. Notwithstanding, we are told that minimizing entrainment by imposing the OMR restriction is the only way to avoid jeopardy, the false choice, and that -5,000 cfs OMR is an absolute threshold, the false certainty. Cementing the outcome, ongoing monitoring of the effectiveness of the policy choices and/or an adaptive management process for implementing and testing alternative management actions is rarely a part of the regulatory requirement. Then, if after years of implementation the chosen actions fail to produce discernable results, the false certainty present at promulgation is replaced by equivocation about the complexity of the system and challenges of demonstrating biological benefit. Meanwhile, the resultant sacrifices by water users continue unabated. Such is the history of the CVP and SWP biological opinions.

If we are to have effective environmental protections and balance various policy objectives, we must be able to test and critically evaluate the performance of the regulations currently in place. As an example, restrictions on the OMR net reverse flow have been in effect for 9 years. This regulation has effectively divorced the water supply for two-thirds of Californians residing south of the Delta from their water sources in the northern Sierras. Practically, the OMR restriction limits CVP and SWP pumping to about one-third of the Projects’ physical capacity, and to about 40% of what would be allowed under the state’s Water Quality Control Plan. As a result, the Projects have pumped less water throughout this 9 year period than in any other equivalent timeframe in Projects’ history. Yet, despite the significant cuts to pumping, delta smelt and winter-run salmon have continued to decline, raising questions as to the effectiveness of the OMR regulation. In addition, the analyses that supports the hypothesis that increasing negative OMR can result in increased fish salvage and reduced survival also demonstrate that high negative OMR can result in little and even no salvage. So, apparently other factors are at work. However, when public water agencies have requested testing pumping rates higher than allowed under the BiOps, the FWS and NMFS have disapproved. Essentially, the rationale is that an experiment to test the efficacy of operational limits set under the BiOps is not allowable because it would result in operations that exceed the limits set by the BiOps. Under this logic, we can never change the existing standard because we can never test a greater alternative management threshold.

Another example is a calendar restriction on pumping based upon a proportion of San Joaquin River inflows (Inflow:Export ratio) in the April and May timeframe under the NMFS BiOp. Essentially, in the BiOp NMFS states that what is needed to improve outmigration for listed steelhead is greater San Joaquin River flow, however, since they were unable to achieve that via the BiOp, they chose to implement a pumping restriction instead. In recent years there have been experimental survival studies

conducted in the San Joaquin River and Delta that have not detected a relationship between exports and survival of juvenile steelhead. Studies conducted with salmon have produced similar results. Unfortunately, although the available steelhead survival studies had variable pumping rates, no steelhead survival studies have tested export effects outside the boundaries of the NMFS BiOp, so they do not tell us if a greater pumping limit would also be appropriate. In order to truly assess the efficacy of this regulation, and others, in order to improve pumping potential, experimentation over a wide range of conditions is necessary; otherwise, we can be assured that when future storms come, we will not be able to capture that water either.

NEED FOR COMPREHENSIVE SOLUTIONS

The desperation behind so many of today's regulatory proposals stem from the natural concern regarding the current status of delta smelt and winter-run salmon. But too often, we are asking the wrong questions. How are the projects causing the problem, to which we have invested millions, as opposed to what is the problem, which is a very different, far more important questing that we have invested little. If we are to extricate ourselves from the species abundance, water supply death spiral we are in, we must finally begin to develop and implement comprehensive and coherent approaches that begin to address the multiple stressors we know are at work. Clearly, the current management approaches are not working but we have an opportunity before us to embrace a more diverse set of management actions over a larger spatial scale. We have the technical ability, but do we have the will?

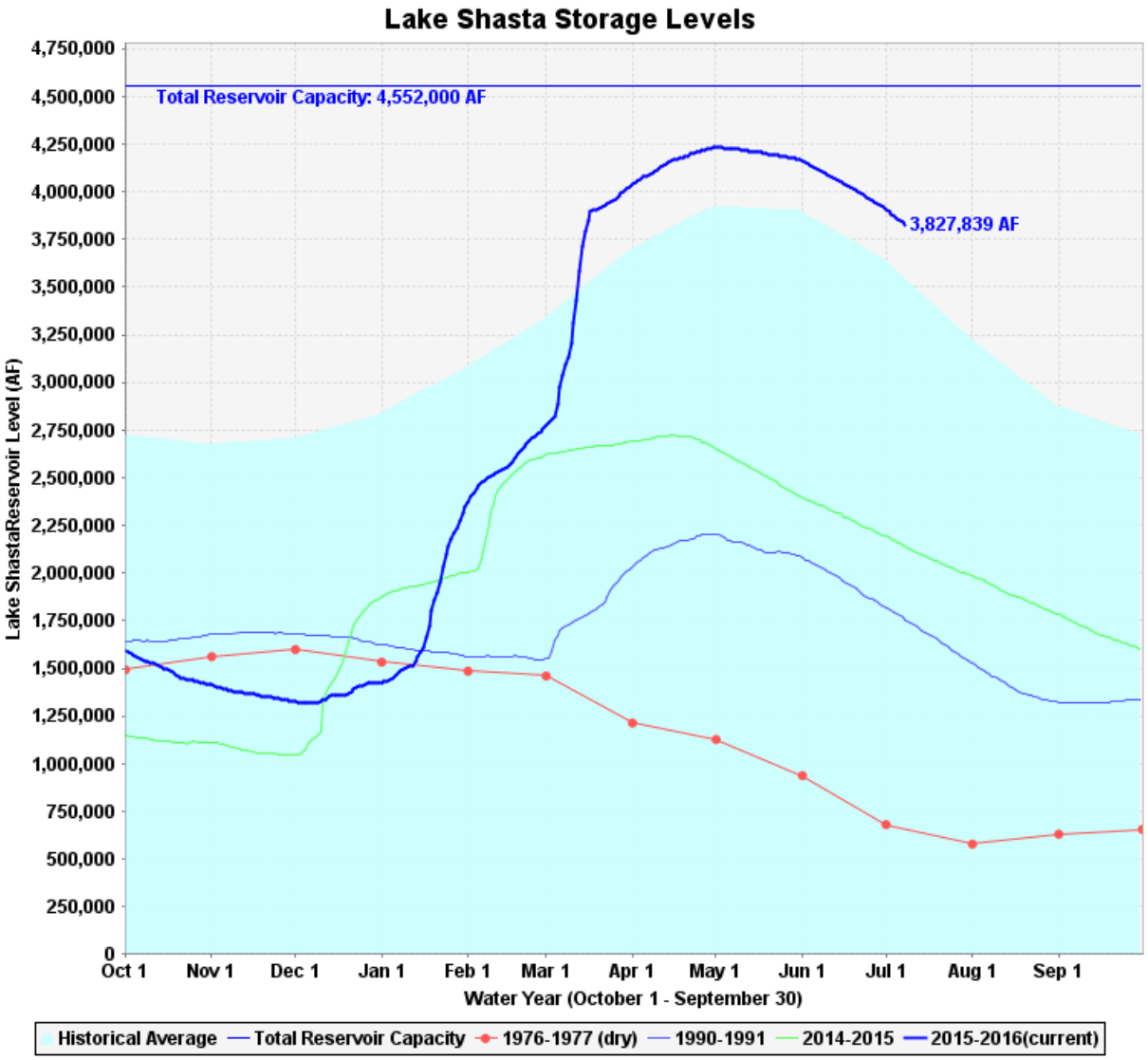
NEED TO ADDRESS NEEDS IN THE NEAR TERM

For about a decade now, the Projects and regulatory agencies have been generally focused on two areas, immediate needs, as in today's fire drill, or long term planning, such as storage or conveyance projects, like California Water Fix, that may go into operation a decade or more from now. What has been left out is everything in between. As examples, the habitat restoration called for in the BiOps, if implemented with the same zeal as water supply cuts, could have already been providing us important information, and potentially more fish, today. Hatchery improvements and a mark-select fishery could yield the fish industry improved harvest in a few short years. Predator hot spot removal could begin at any time and provide immediate relief from a significant form of fish mortality. It is not a lack of good ideas standing in our way; rather, it is a lack of will, resources, and leadership. We know what to do, we just have to go and do it.

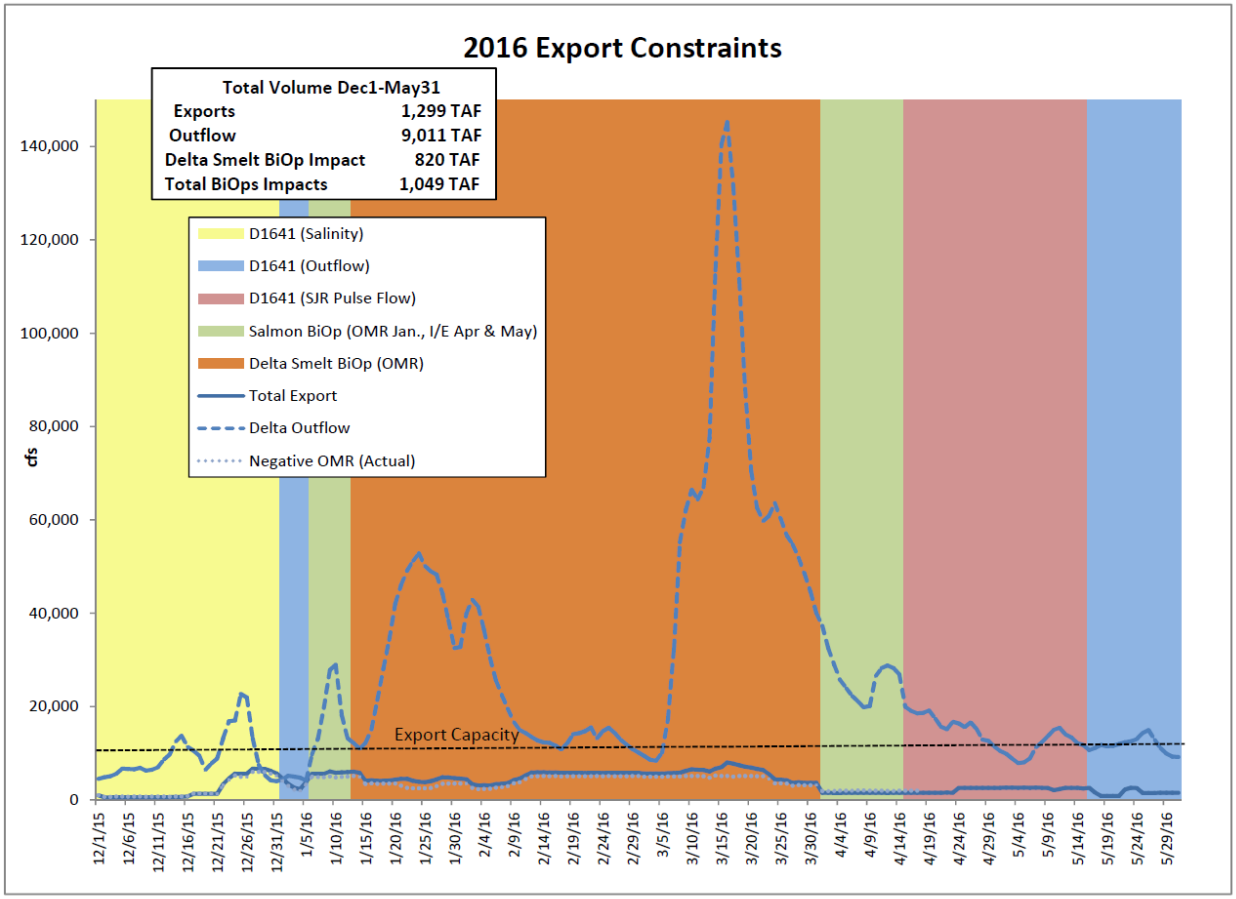
CONCLUSION

In the end, *"Changing Demands and Water Supply Uncertainty in California"* is less about how agriculture and municipalities are using water, we have been doing more with less for decades. Rather, it is about the huge increase in environmental water demand over the last quarter century due to unbridled regulation. But, unlike agricultural and municipal usage which must account for the use and ensure the benefit of each drop, environmental usage undergoes no such scrutiny. On the contrary, its benefit is simply assumed. Looking forward, it is incumbent upon us as servants of the public to question the efficacy of the water, money, and human sacrifice demanded for species management. Clearly some of what we are doing today is wholly ineffective, and yet it continues. We must reassess our approaches, broaden participation, enlist stakeholder support, and demand accountability in decision making if we are to achieve better results. I appreciate the opportunity to testify before you today and would be happy to answer any questions. Thank you.

ATTACHMENT 1



ATTACHMENT 2



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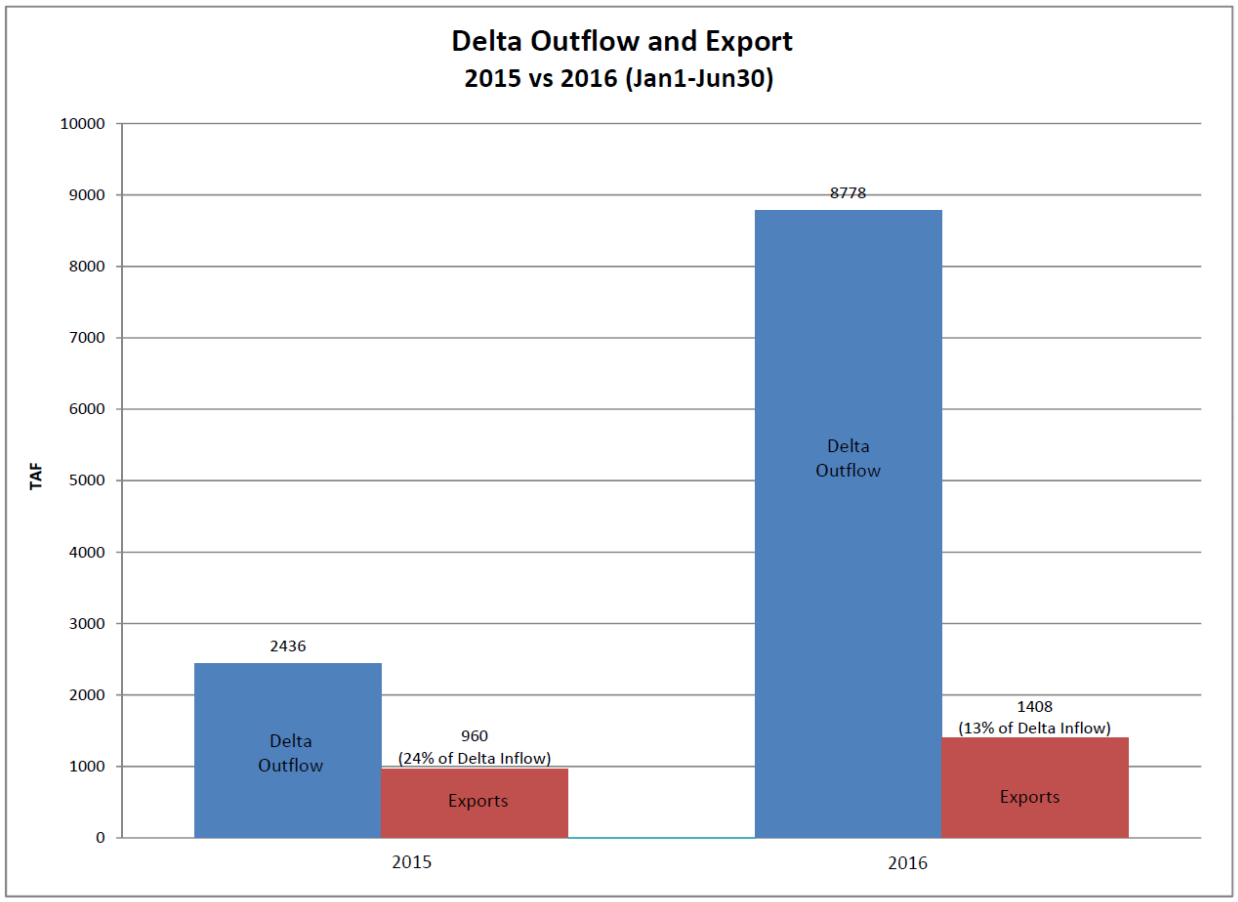
7/7/2016

ATTACHMENT 3



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ATTACHMENT 4