A Review of

Central Valley Project and State Water Project Drought Operations Plan And Operational Forecast April 1, 2014 through November 15, 2014

Balancing Multiple Needs in a Third Dry Year

10 May 2014

Summary and Conclusions

State Board Orders and the April Drought Plan call for changes in Delta water quality standards that increase already high risks to listed salmon, steelhead, and smelt.

1. Decreased outflow requirements in spring and summer will reduce the amount of low-salinity habitat in the Delta critical to Longfin and Delta smelt, and reduce migration cues for salmon and steelhead that must pass through the Delta from Central Valley rivers to the ocean.
2. The proposed change in lower Sacramento agricultural water quality standard from Emmaton to Three Mile Slough will raise Delta salinities and allow further reductions in Delta outflows to the detriment of smelt, salmon, and steelhead.
3. Allowing 1:1 export of water transfers and the San Joaquin Apr-May flow pulse along with the shift of exports to the Tracy (Jones) pumping plant will severely reduce survival of San Joaquin Valley rivers' salmon and steelhead production by eliminating their migration corridor in April and May.
4. Potential barrier installations at the head of Sutter and Steamboat sloughs in the summer will lead to reduced Delta inflow and outflow and a reduction in the freshwater inflow to the critical Cache Slough smelt habitats in the North Delta.
5. Potential barrier installation on West False River, if accompanied by opening of the Delta Cross Channel and a positive Q-West flow, could have beneficial effects. However, this barrier would impact boating and full environmental and public review would need to occur before CSPA could support this proposal.

Introduction

The Drought Operations Plan and Operational Forecast (the Plan) was formulated in early April by the U.S. Bureau of Reclamation (Reclamation), California Department of Water Resources (DWR), U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), California Department of Fish and Wildlife (CDFW), and the State Water Resources Control Board (State Water Board). The Plan included a series of emergency measures including several Delta channel barriers, and changes in Delta water quality standards and export operations that would conserve water in reservoirs. The Plan has since been modified based on evolving conditions, principally improvements in water supply in the Central Valley from late winter and early spring rainfall. Because of these improvements some of the emergency actions in the Plan may not be implemented; however, critical water year operations will persist because of very low reservoir and snowpack levels.

DWR continues its original request (April letters) to revise water quality standards for Delta salinity. The agency requests reductions in prescribed Delta outflow in spring and summer, and a change in the compliance location for the Agricultural Western Delta Salinity Standard.

This review of the Plan focuses on the environmental effects of the proposed emergency actions, including proposed changes in the Delta salinity standard and expected normal operations in a critical year from late spring through summer. We begin with a summary of the 2014 drought and what was being proposed in the Plan, and follow with an

assessment of what likely will occur under proposed and existing water quality standards and biological opinions for listed Delta fish species.

The Drought

The 2014 drought is a consequence of record low rainfall, snowpack, and reservoir levels through the end of January 2014. This year being the third year of a multiyear drought made conditions all the worse. But like most drought years, storms in late winter and spring usually bring some relief and 2014 was no different. Three storm periods from February to early April brought moderate flows into the reservoirs and Valley streams, as can be seen in Figure 1. Reservoir storage nearly doubled, although achieving only 50 percent of normal for spring. Snowpack remains critically low.

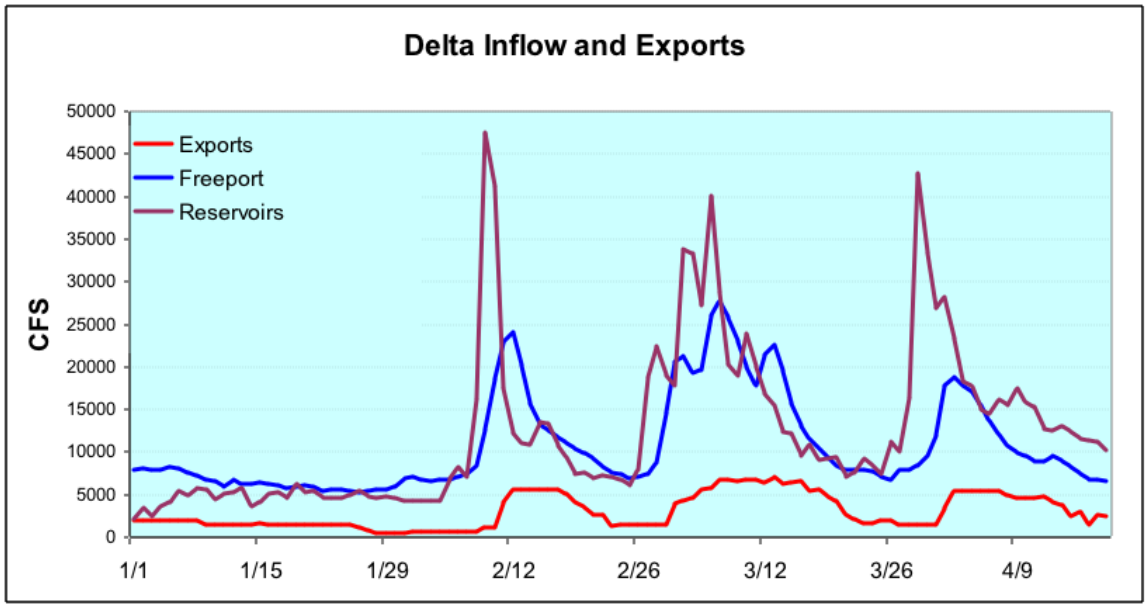

Figure 1. Total Delta exports, Project reservoirs inflow, and Sacramento River Delta inflow 2014. Reservoir inflow is total of four Project reservoirs. Exports are the total of Clifton Court and Tracy pumping plants. Reservoir inflows were stored in the four large reservoirs (Shasta, Oroville, Folsom, and New Melones). Sacramento River at Freeport flows were primarily made up of the flows of the many Sacramento Valley streams that flow undammed into the Delta. Major contributions came from Cow, Cottonwood, Battle, Deer, and Mill creeks and the Yuba River.

Drought Plan and Proposed Actions

The Drought Plan proposed a series of emergency actions including (1) installation of three channel barriers, (2) changes to Delta salinity standards, and (3) opening of the Delta Cross Channel (DCC). The actions are prescribed to save storage in reservoirs and reduce effects of salt intrusion into the Delta. The barriers would reduce salt intrusion into the Central and South Delta reducing the need for reservoir releases to hold the salt back. The change in the salinity standard would allow some salt encroachment with lower Delta freshwater outflow from lower reservoir releases. Opening the DCC would further lower salinity in the Central and South Delta, thereby reducing the amount of salt in the water exported.

The barriers, DCC opening, and changed standards are prescribed to reduce Delta freshwater inflow needs, thus saving reservoir storage. With low storage, cold-water releases from the project reservoirs (principally Shasta Reservoir) cannot be sustained through the summer. The Plan requests reductions in Delta outflows from a minimum of 3000 cfs to 2000 cfs in spring and 4000 cfs to 3000 cfs in summer, thus saving up to several hundred thousand acre-feet of reservoir storage over the next six months.

The USFWS and NMFS have endorsed the combined actions (with some caveats) because effects are not expected to have significant and dramatic effects on salmon, smelt, and other Delta species that depend on the freshwater flow and low-salinity habitat of the Delta for their reproduction and survival. The USFWS has only recently (May 2) approved the summer actions, after asking for further information and analyses before approving.

Our Assessment of the Plan

Our review of the Plan and its potential effects on listed salmon, steelhead, and smelt indicates that the risks to the species are too extreme and should be reevaluated. We believe the existing protections in dry years for salmon, smelt, and steelhead are inadequate to protect the species, and relaxing standards as proposed would further jeopardize the species and their critical habitats. It was during these multiyear droughts (1976-77, 1987-92, 2001-02, 2007-09, and 2012-14) that the most dramatic declines in the listed species and their habitats[1] have occurred. Protections under the respective biological opinions and Delta D-1641 water quality standards have proven inadequate, yet further damaging actions are being prescribed and approved by the agencies responsible for protecting the listed species and their critical habitats.

In our view, it is mismanagement of the water supply resources during the first two years of the drought that got us into this crisis of low reservoirs during this third year of drought. It is the excessive drawdowns of the reservoirs in the first and second year of droughts that causes these crises.

Winter-Spring 2014

We begin this review with an assessment of what occurred in this past winter (January through March) after Reclamation and DWR sought a temporary modification to their water rights permits and licenses on January 29. The Executive Director of the State Water Board issued an Order that granted temporary modification for the next 180 days in response to drought conditions on January 31. At the time low Delta inflows and outflows, along with prerequisite low exports were representative of the major drought of 2014 (see Figure 1). It was not until February that a reprieve from Mother Nature provided reasonable hydrology for winter-spring migrations and rearing for migrating

[1] Many of the habitat changes have had permanent consequences including the invasion of many non-native aquatic plants and animals, and catastrophic declines in many native species that depend on their native habitats.

and rearing salmon, steelhead, and smelt. Populations of Longfin and Delta Smelt that had been heavily impacted the last two years benefited from an improvement in Low Salinity Zone (LSZ) habitat, while wild salmon young had decent flows to move from Valley rivers to Bay-Delta nurseries.

The State Board's Executive Order came in late January before the storms, when flows and exports were low. In late January it was Longfin Smelt at risk (Figure 2). The Order allowed the Projects to reduce Delta outflow below the 7100 cfs standard and thus conserve upstream storage for use later. With lower outflow (4000-5000 cfs), the LSZ and smelt larvae concentrations were in the lower Sacramento and San Joaquin River channels where the pelagic larvae are very vulnerable to being drawn to the export pumps in the south Delta. The Order also allowed the Delta Cross Channel (DCC) to be opened to reduce salt water in the South Delta exports as with the DCC closed much of the water to meet the export demand comes from north down Old and Middle Rivers from lower San Joaquin channel near Jersey Point and Three Mile Slough (Figure 3).

The lower Delta outflow put Longfin smelt at substantial risk. On each high tide 50,000 cfs of tidal flow passes east through False River from Jersey Point to Franks Tract on Old River. Given the density of Longfin Smelt larvae in the late January smelt larval survey sample at Jersey Point was 383 per 1000 cubic meters, millions of larvae were passing east into Franks Tract and Old River on each tide. Because of this vulnerability, the water quality standards called for low exports under such low Delta inflow/outflow conditions to minimize reverse flow down Old River to the South Delta export pumps. The Delta Cross Channel was opened from February 1 to February 9 to limit salt in the state and federal project exports. However, the lower exports and open DCC did not stop the tidal pumping of smelt larvae into the Central and South Delta.

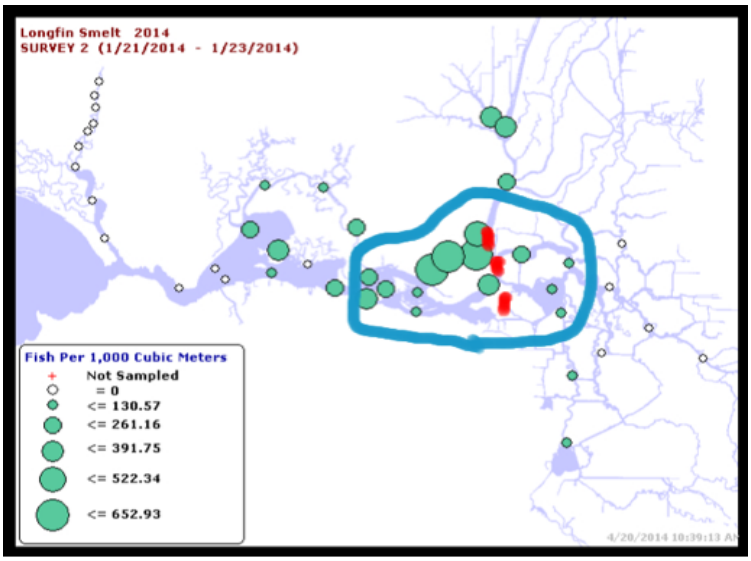

Figure 2. The Longfin Smelt larvae distribution in late January from the Smelt Larval Fish Survey. The blue boundary depicts the Low Salinity Zone (LSZ) considered the major nursery area of many native Delta fishes. The red line is the location of X2, the approximate location of the 2 parts per thousand salinity level in the estuary, which is a parameter in many Delta fish protection criteria

because young fish tend to concentrate at or near this location in the estuary. Delta outflow at this time was approximately 4600-4800 cfs. Delta exports were 2500 cfs.

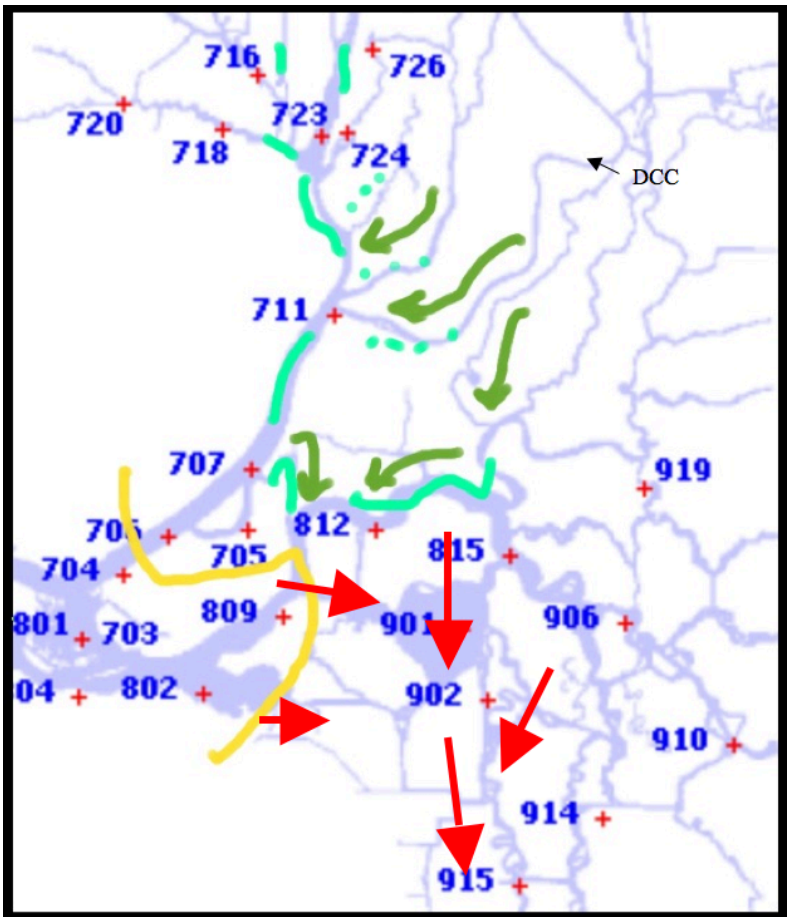

Figure 3. Late January 2014 conditions. Most of the freshwater inflow to the Delta came from the North (green arrows). Most of the export water was drawn from the North (red arrows). Low salinity Bay water occurred to the west (yellow line). Longfin and Delta smelt traditionally spawn above the low salinity zone in freshwater areas (depicted by light green lines and dots). Newly hatched larval smelt are thus vulnerable to export from the South Delta. Under these conditions about 20% of the freshwater inflow was being exported. Note these are the station numbers for the survey sampling depicted in Figure 2.

When the rains came in February, the Orders allowed higher South Delta exports accompanied by higher inflows and outflows for most of the late winter and early spring. With the rains most of the larvae Longfin Smelt shifted west with the LSZ (Figure 4). However, with the DCC again being closed, the higher Delta inflow was focused down the lower Sacramento River channel, while inflow to the lower San Joaquin River (Jersey Point to Prisoners Point) remained low. This section of river is heavily impacted by exports. With the LSZ and smelt extended upstream to Jersey Point in the lower San Joaquin channel, a portion of the smelt population remained extremely vulnerable to the increased exports. Larvae drifting downstream from spawning areas in the North Delta also remained vulnerable to drifting south into the Central Delta and Old River via Three Mile Slough.

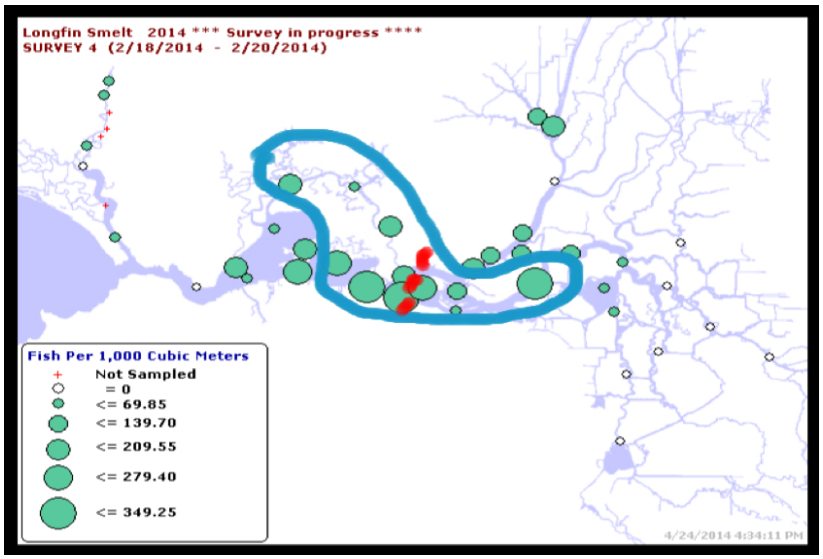

Figure 4. The Longfin Smelt larvae distribution from the Smelt Larval Fish Survey of February 18-20, 2014. The blue boundary depicts the Low Salinity Zone (LSZ) considered the major nursery area of many native Delta fishes. The red line is the location of X2, the approximate location of the 2 parts per thousand salinity level in the estuary, which is a parameter in many Delta fish protection criteria because young fish tend to concentrate at or near this location in the estuary. Delta outflow at this time was approximately 7000 cfs. Delta exports were 5000 cfs. Sacramento River inflow to the Delta was 12,000 cfs. San Joaquin River inflow was 800 cfs. The DCC was closed, thus forcing most of the Delta inflow down the lower Sacramento River and allowing the LSZ to extend upstream in the lower San Joaquin channel.

The original Order and the Drought Plan allow lower Delta outflow than Delta Plan D-1641, which contributes to the upstream movement of the LSZ with corresponding higher salinities in the West Delta. The Plan also allows moving the salinity standard for the lower Sacramento River from Emmaton to Three Mile Slough, which results in the agricultural salinity standard moving upstream from station 705 to 707 in Figure 3. Delta smelt and their LSZ habitat is subject to significantly increased risk with 35-45% of the inflow allowed for export through spring. This is the basis of the Delta smelt and salmon biological opinions, which constrain exports by limiting flows from the lower San Joaquin River down Old and Middle Rivers to minus 5000 cfs (essentially limiting exports to a maximum of 5000-6000 cfs). However, even these export restrictions do not keep smelt larvae and young salmon from being drawn into the South Delta exports.

The rains changed conditions dramatically in the Delta into March. Though much of the rain was stored in Valley reservoirs, flows from the undammed streams (especially Cow Creek and the Yuba River) passed through the Valley to the Delta. The higher Freeport Delta inflows (Figure 1) freshened the Delta and allowed more exports under the existing export rules (exports are allowed under the standards and orders to rise to 35% as long as outflow is above 7100 cfs). Even with exports nearing 6,000 cfs, the increase inflow and outflow benefitted fish habitat by pushing the LSZ and X2 downstream, west toward the Bay. While the smelt in the LSZ were somewhat less vulnerable to exports, the Longfin and Delta Smelt larvae moving downstream from spawning areas in the North Delta were vulnerable to being diverted to the increasing exports especially with the DCC closed

(Figures 5 and 6). With the DCC closed, most of the new inflow came down the lower Sacramento River channel while most of the export water came from the central Delta where smelt were concentrated. (Note: Opening the DCC and maintaining a positive Q-West flow in the San Joaquin River would move the LSZ downstream in the lower San Joaquin channel further from the influence of the exports - the lower right extension of the LSZ at station 809 in Figure 3 would be moved further west).

These conditions are the norm for late winter and early spring in drier years under the existing Delta standards as shown in Figures 7 and 8 for March 2013. Under the existing standards, Longfin and Delta smelt are simply not protected from Delta exports of 5000 cfs allowed under the OMR limits of the biological opinions, especially with the DCC closed and a negative Q-West. The relaxation of the 7100 cfs outflow standard through June, albeit under the restricted export limit of 1500 cfs, places the smelt populations at extreme risk, especially when rainstorms and increased Sacramento River inflow allow exports to increase to the OMR limit of 5000 cfs.

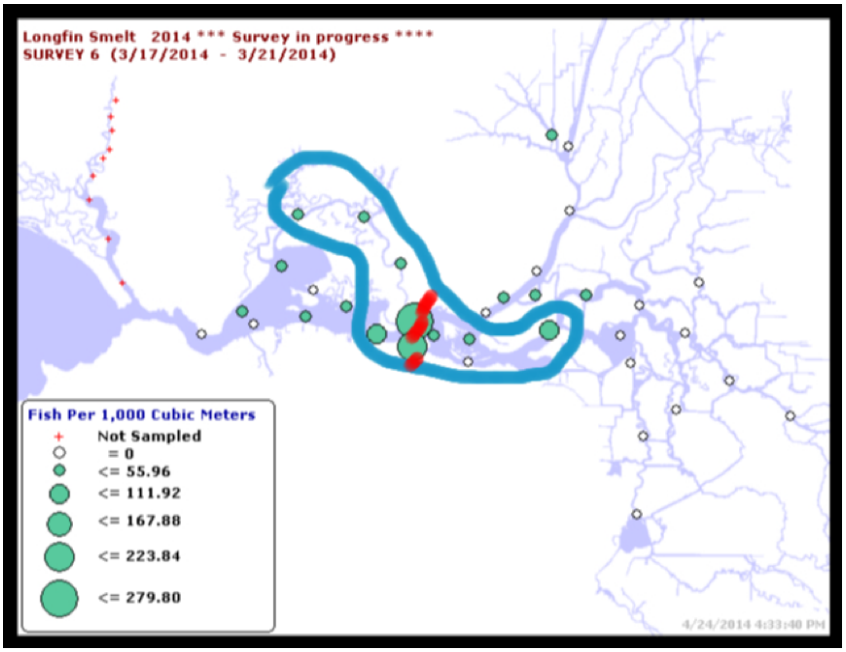

Figure 5. The Longfin Smelt larvae distribution from the Smelt Larval Fish Survey of March 17-21, 2014. The blue boundary depicts the Low Salinity Zone (LSZ) considered the major nursery area of many native Delta fishes. The red line is the location of X2, the approximate location of the 2 parts per thousand salinity level in the estuary, which is a parameter in many Delta fish protection criteria because young fish tend to concentrate at or near this location in the estuary. Delta outflow at this time averaged over 7000 cfs. Delta exports were 5000 cfs. Sacramento River inflow to the Delta was 8,000-13,000 cfs. San Joaquin River inflow was 800-1000 cfs. The DCC was closed, thus forcing most of the Delta inflow down the lower Sacramento River and allowing the LSZ to extend upstream in the lower San Joaquin channel.

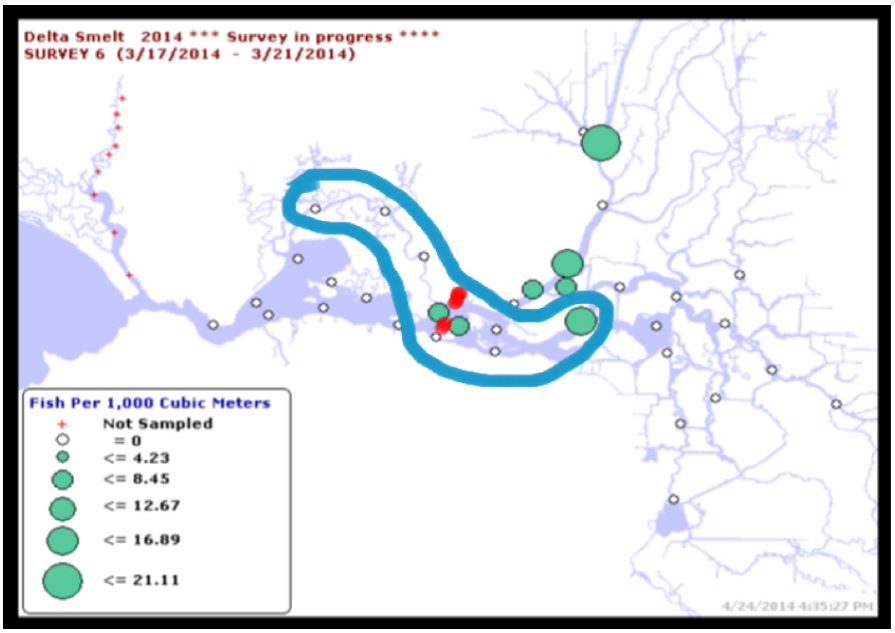

Figure 6. The Delta Smelt larvae distribution from the Smelt Larval Fish Survey of March 17-21, 2014. The blue boundary depicts the Low Salinity Zone (LSZ) considered the major nursery area of many native Delta fishes. The red line is the location of X2, the approximate location of the 2 parts per thousand salinity level in the estuary, which is a parameter in many Delta fish protection criteria because young fish tend to concentrate at or near this location in the estuary. Delta outflow at this time averaged over 7000 cfs. Delta exports were 5000 cfs. Sacramento River inflow to the Delta was 8,000-13,000 cfs. San Joaquin River inflow was 800-1000 cfs. The DCC was closed, thus forcing most of the Delta inflow down the lower Sacramento River and allowing the LSZ to extend upstream in the lower San Joaquin channel.

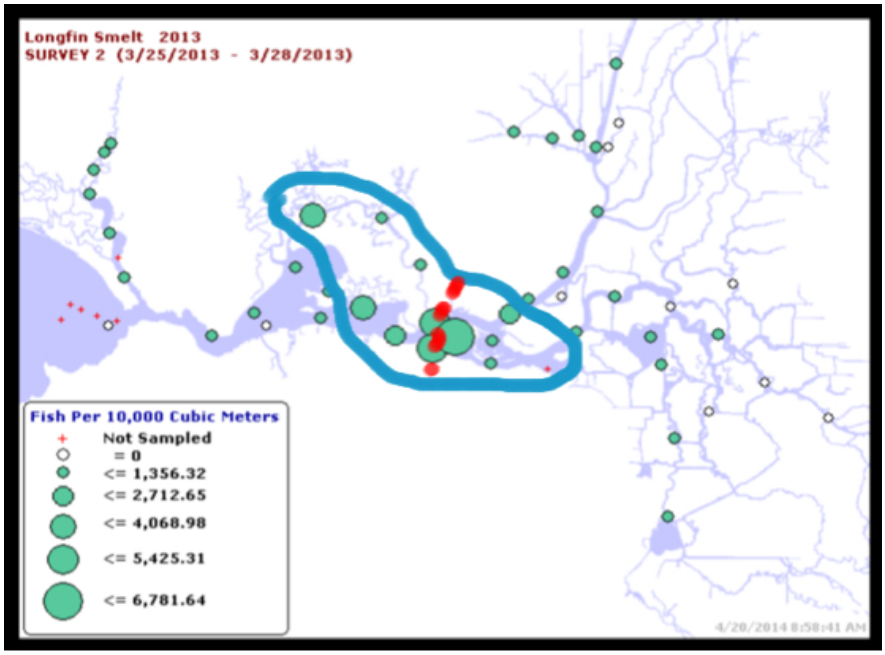

Figure 7. Longfin Smelt distribution in Smelt Larval Survey in late March 2013. Exports were near 5000 cfs, outflow was 7000-8000 cfs, and the export/inflow ratio near 40%.

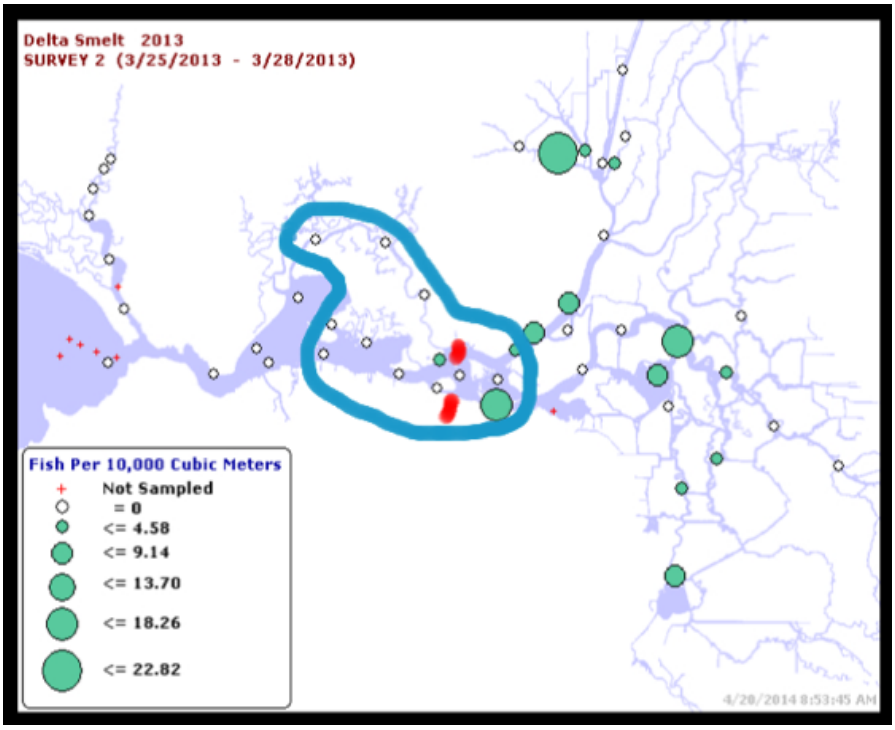

Figure 8. Delta Smelt distribution in Smelt Larval Survey in late March 2013. Exports were near 5000 cfs, outflow was 7000-8000 cfs, and the export/inflow ratio near 40%. Clearly, smelt were vulnerable to South Delta exports under these outflows. Reduction of outflows allowed under the Orders to 3000-4000 cfs would make smelt more vulnerable to the direct (entrainment) and indirect (predation and habitat) effects of exports.

In addition to the smelt, the changes that occurred this winter and spring have also had consequences to listed salmon and steelhead. The reduced Delta outflow (relaxed 7,000 cfs Delta outflow standard to 3000-4000 cfs) reduces the migration cues of freshwater outflow from Valley rivers to the Bay. Hatchery salmon initially were provided tanker truck rides to the Delta at the beginning of April, but later were released at upstream hatcheries to move naturally with the last of the storm flows in early April. Trucking was resumed soon thereafter. Many young wild salmon moved to the Delta during the storms. The opening of the DCC in early February for a week allowed some salmon to enter the Central and South Delta, thus subjecting them to poor habitat and exports. Unlike the Sacramento Valley salmon, San Joaquin Valley salmon were subjected to low flows and the higher exports allowed under the Sacramento Valley rainstorms. These included the 50,000 hatchery spring run Chinook reintroduced to the San Joaquin in April. A switch to exporting from the CVP Tracy (Jones) Pumping Plant allowed under the Order and Plan placed more risk on the San Joaquin salmon (Figure 9). The same risk applies to listed Central Valley steelhead, especially San Joaquin populations (Figure 10). The benefits of the April-May mandated pulse flows on the San Joaquin for salmon and steelhead are negated because the State Board Order allows the pulse flows to be exported. Prior to 2010, exports were limited to 1500 cfs by the VAMP program, but now may exceed 3000 cfs. With the DCC closed essentially all the San Joaquin River inflow to the Delta is exported from the South Delta.

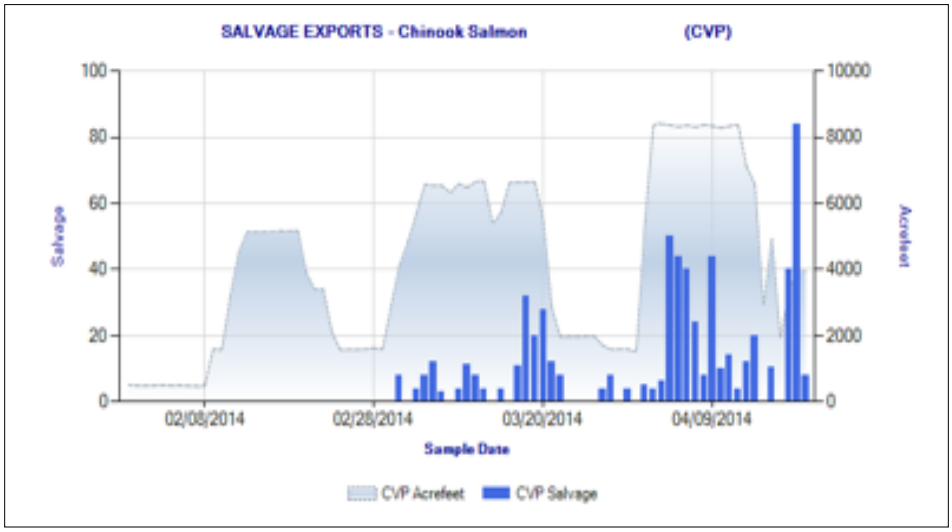

Figure 9. Winter-spring 2014 exports of salmon at CVP Tracy (Jones) pumping plant in South Delta.

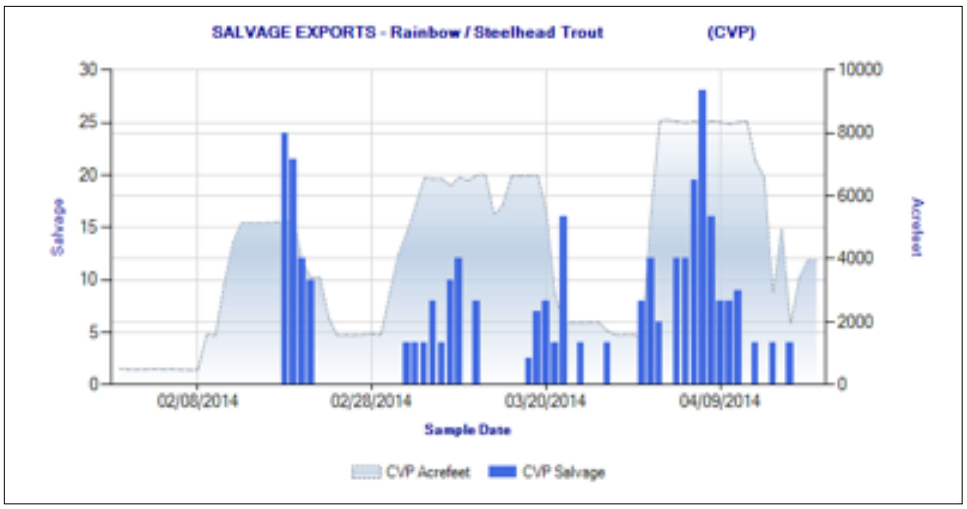

Figure 10. Winter-spring 2014 exports of listed Central Valley steelhead at CVP Tracy (Jones) pumping plant in South Delta.

Modifications of the original orders and the April Plan proposed by Reclamation and DWR would continue the relaxation of Delta salinity standards and allow reductions in outflows required under the standards through June. Smelt remain vulnerable under these conditions (Figures 11-12).

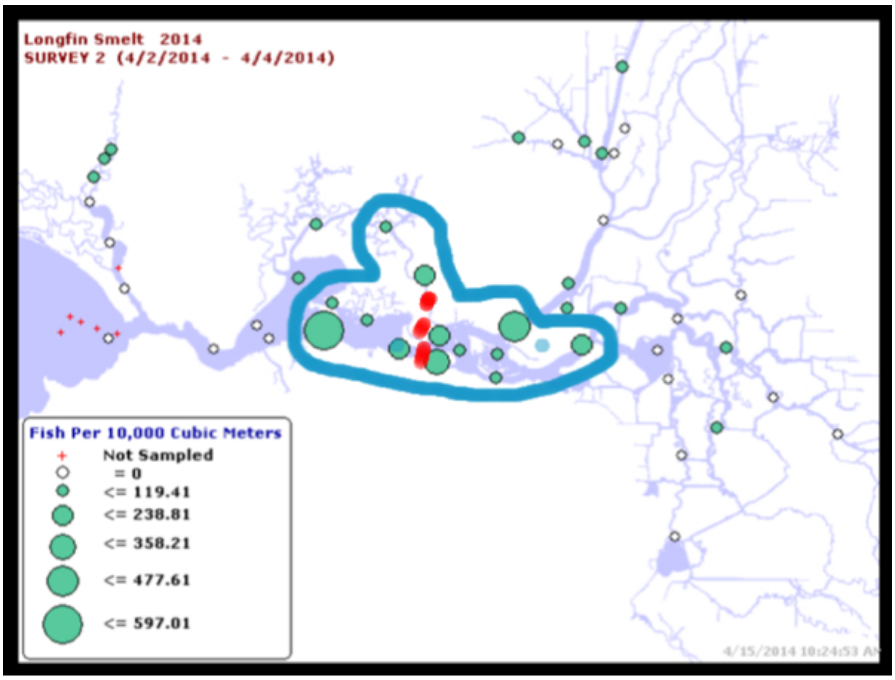

Figure 11. With higher inflows and outflows the LSZ (blue border), X2 (red line), and concentrations of larval Longfin Smelt were moved west (compared to Figure 2) by early April. However, on the lower San Joaquin, the LSZ remained upstream in the Central Delta with the DCC closed under the higher exports.

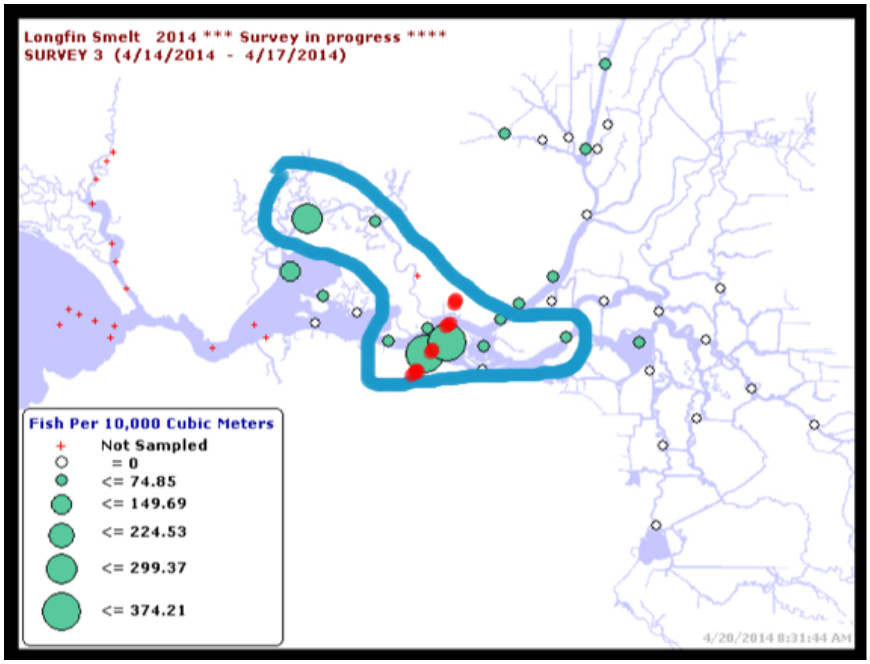

Figure 12. With higher inflows and outflows the LSZ (blue border), X2 (red line), and concentrations of larval Longfin Smelt were moved west (compared to Figure 2) in mid April. However, on the lower San Joaquin, the LSZ remained upstream in the Central Delta with the DCC closed under the higher exports.

The Order and Drought Plan will result in additional changes for May and June. The basic rules that include the 35% export/inflow standard, 7100 cfs outflow requirement, minus 5000 cfs down Old and Middle Rivers (OMR biological opinion restrictions), and X2 located on average at Jersey Point on the lower San Joaquin River and Emmaton on the lower Sacramento River (stations 809 and 704, respectively in Figure 3) remain unchanged. The changes proposed are to move the salinity (X2) standard to Three Mile Slough (station 707) and to reduce outflow to 3000 cfs minimum. The DCC normally remains closed for most of the period, but could be opened under the Plan.

Longfin and Delta smelt will remain vulnerable to exports under these conditions as seen in Figures 13 through 15 under similar circumstances from spring 2013 surveys. If the inflow and outflow required to export cannot be met by rainfall or reservoir releases, conditions would revert to the minimum exports and outflows of the State Board order (1500 cfs plus an unknown volume of water transfer exports and 3000 cfs outflow), except that the San Joaquin pulse flow (3000 cfs) and water transfers can be exported on a 1:1 basis. These would be result in conditions slightly worse than shown in Figure 2. Allowing the Emmaton salinity standard (2.78 EC) to be moved to Three Mile Slough (TMS) would result in high risk to smelt as in Figure 2 when there was a steady stream of smelt and brackish water moving down Old River to the South Delta export pumps. (Note: while the distance between EMM and TMS is only about 2.5 miles the effect is significant because much of the flow to the South Delta exports from the Sacramento River is through TMS (the remainder is from Georgiana Slough). The change can markedly reduce net freshwater flow in the lower Sacramento River channel above and below TMS and potentially change EMM salinity from 2 to 5 EC and allow X-2 (the red line in Figure 13) to move upstream two miles and result in further reduction in Delta outflow.

Through the remainder of May and June Longfin and Delta smelt will remain vulnerable to exports <u>with</u> or <u>without</u> reservoir releases. With the opening of the DCC in late June, risks to smelt could be reduced, as several thousand cfs of fresh Sacramento River water would be drawn down the Mokelumne River channels into the Central Delta. While smelt would likely benefit from the change, more young salmon from the Sacramento River would be diverted to the East and South Delta and, potentially, to the export pumps unless a positive Q-West was maintained.

As noted, the risk to Delta Smelt and Longfin Smelt from water exports would likely be reduced throughout the May-June period if the DCC were opened and a positive Q-West maintained on the San Joaquin River because the LSZ would be pushed westward. Installation of barriers on False River and Dutch Slough (the two red arrows pointing east in Figure 3 toward stations 901 and 902) could potentially provide additional benefit because they would reduce smelt and their habitat from being drawn into Franks Tract toward the export facilities. However, the False River and Dutch Slough barriers would be problematic for boating in the area and, in any case, would need to undergo complete environmental assessment and public review (something that is not likely to occur) before

CSPA could be supportive. More detail on this subject is provided in Figures 16, 17, and 18.

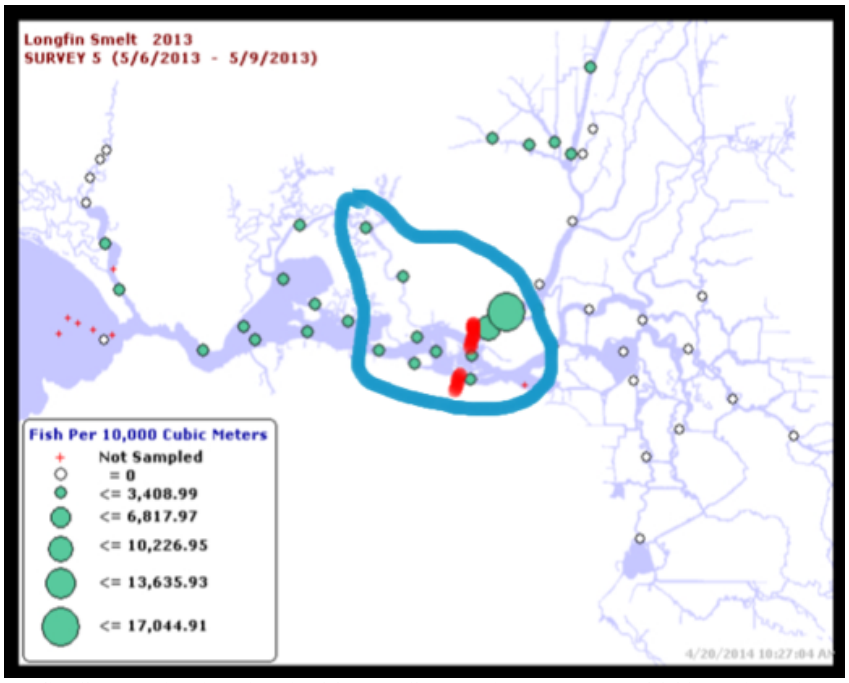

Figure 13. Longfin Smelt distribution in 20-mm Survey in early May 2013. With higher inflows and outflows the LSZ (blue border), X2 (red line), and concentrations of larval Longfin Smelt are in West Delta, but remain vulnerable to exports with the DCC closed.

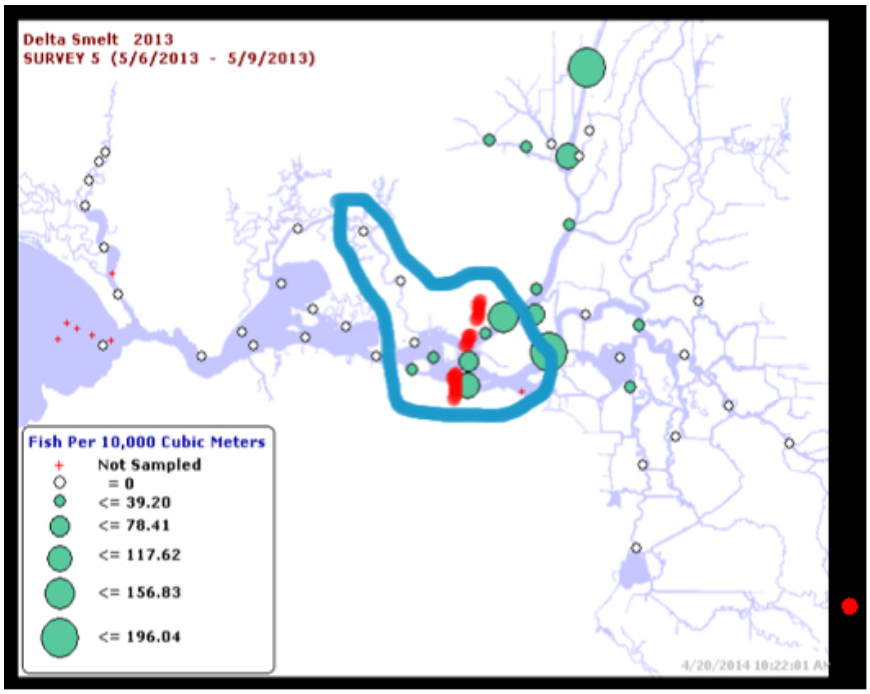

Figure 14. Delta Smelt distribution in 20-mm Survey in early May 2013. With higher inflows and outflows the LSZ (blue border), X2 (red line), and concentrations of larval Delta Smelt are in West Delta, but remain vulnerable to exports with the DCC closed.

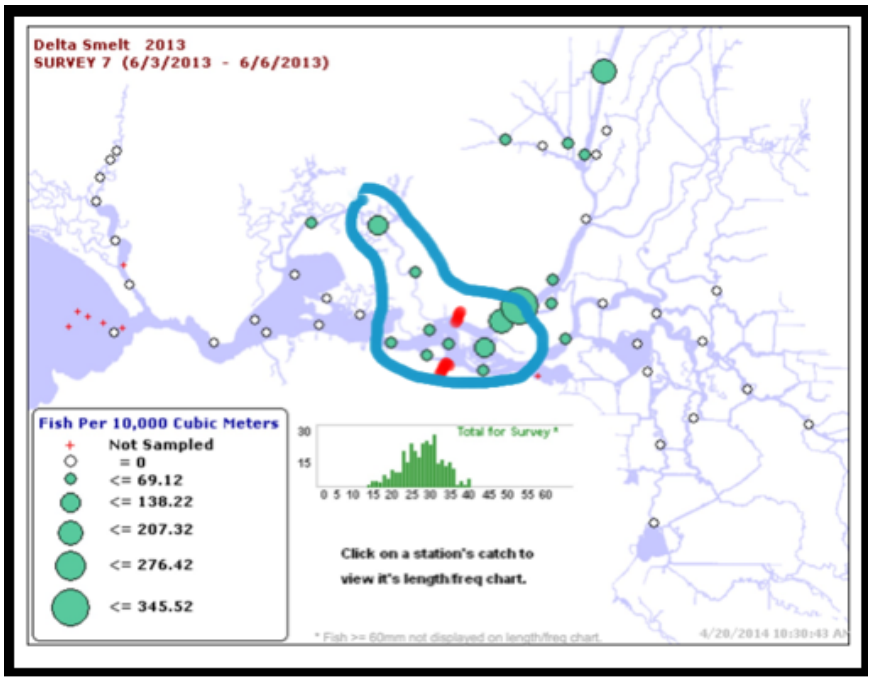

Figure 15. Delta Smelt distribution in 20-mm Survey in early June 2013. With higher inflows and outflows the LSZ (blue border), X2 (red line), and concentrations of larval Delta Smelt are in West Delta, but remain vulnerable to exports with the DCC closed.

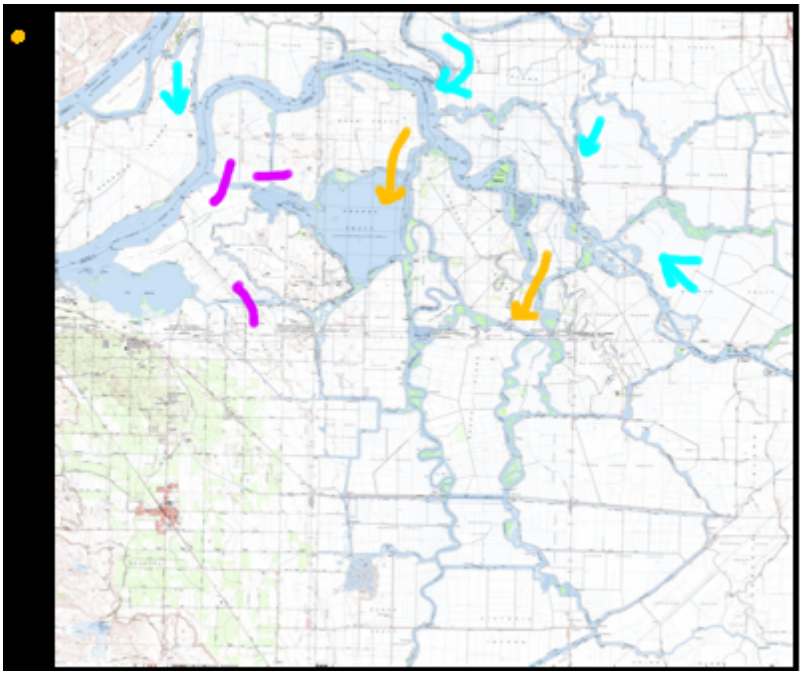

Figure 16. Barriers on the channels between the West Delta and Franks Tract in the Central Delta (purple lines) would increase the proportion of South Delta export water (orange arrows) coming from the East Delta (right three blue arrows) and reduce water coming from West Delta and Three Mile Slough (left blue arrow).

Figure 17. West Delta connections to Central Delta. Under existing rules in May and June with the DCC closed, most of the South Delta export water is drawn from the north via Franks Tract and Old River. Water flows to this route via the three yellow arrows in this photo. Turbid West Delta water can be seen flowing east across Franks Tract from False River. Freshwater enters the area from the north (Sacramento River) via Three Mile Slough (left blue arrow) and Georgiana Slough (right blue arrow). Barriers on False River and Dutch Slough would eliminate flood tide flows from the West Delta to Franks Tract.

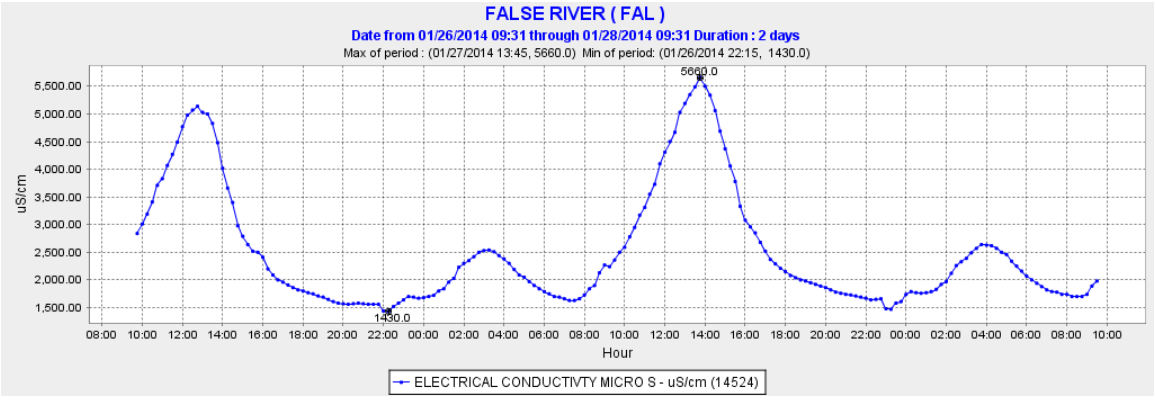

Figure 18. Chart of salinity (EC) in False River in late January during period of low outflow. Graph depicts brackish LSZ water entering False River (and Franks Tract) on flood tides. A barrier on False River would eliminate this transport of salt and smelt (see Figure 2) from the West Delta via Franks Tract on Old River to the South Delta exports.

Summer 2014 – July through September

The risk to smelt during the summer of this critical year will remain extreme despite agency assurances that smelt are not vulnerable to exports in summer. Summer Delta outflow is required to be a minimum of 4000 cfs in critical years. However, DWR requests a reduction to 3000 cfs along with the change in Agricultural salinity standard from EMM to TMS. Although the DCC is open in summer, the proposed changes will result in conditions that will put smelt and their LSZ habitat under severe risk from exports and excessive temperatures. Both the Longfin and Delta smelt reside in the LSZ through the summer. The 4000 cfs outflow standard is designed to keep smelt in Suisun Bay and saltwater out of the Central Delta.

Water temperature of 77˚- 80˚ F (25-27C) are lethal to Delta smelt and 73˚-75˚ F (23-25C) temperatures are highly stressful. Indeed, smelt are almost never found in 73˚ F waters. Drawing the LSZ eastward runs the risk of repeating the disaster that occurred in early July 2013 when exports were increased to 9000-10000 cfs and outflow dropped below 5000 cfs. The LSZ and the majority of Delta smelt were drawn into the Delta where they encountered a heat wave and warm inflow waters. Water temperatures reached 77˚-80˚ F. and only the remnant of Delta smelt that remained in eastern Suisun Bay survived. See figures 19 and 20. Details of this event is chronicled in CSPA's report *Summer 2013; The demise of Delta smelt under D-1641 Delta Water Quality Standards,* prepared by Thomas Cannon. The Delta smelt biological opinion contains no protection for Delta smelt in July because it was believed that outflow standards were sufficient to keep smelt in Suisun Bay and a State Board reduction of Critical Year outflow standards simply wasn't contemplated.

This year, the LSZ will be further east in the West and Central Delta (Figures 19 and 20), and vulnerable to exports with only 3000 cfs outflow. Not only will smelt be more vulnerable to exports, but the LSZ is less productive and warmer when in this eastern position. A reduction in outflow to 3000 cfs would further reduce the size of the LSZ and move it further to the east. The amount of risk to the smelt and their LSZ habitat would depend on the level of exports. Summer exports are only limited by the 65% Export/Inflow restriction at present. The Plan would allow summer water transfers through the Delta at 100% or E/I of 1/1. The 1500 cfs cap on exports does not apply to water transfers, which are likely to be significant this year. Any summer water transfers under these rules would have significant negative effects on Delta Smelt. (Note: transfer water from the north cannot be passed directly to South Delta pumps, it must mix first with LSZ water.)

Because summer conditions are extremely stressful on smelt under existing rules there should be no changes that would increase the stress. Maintaining outflow at least at 4,000 cfs is essential to retain some LSZ habitat and ensure smelt are kept west of the flow to the South Delta export pumps. Reducing exports and maintaining outflows above 4000 cfs would help keep warmer eastern waters out of the Delta and LSZ. Even if outflows are at or above 4000 cfs, if smelt are found to be at high risk in monitoring

surveys, then exports should be reduced and any water transfers that would worsen the problem should not be allowed.

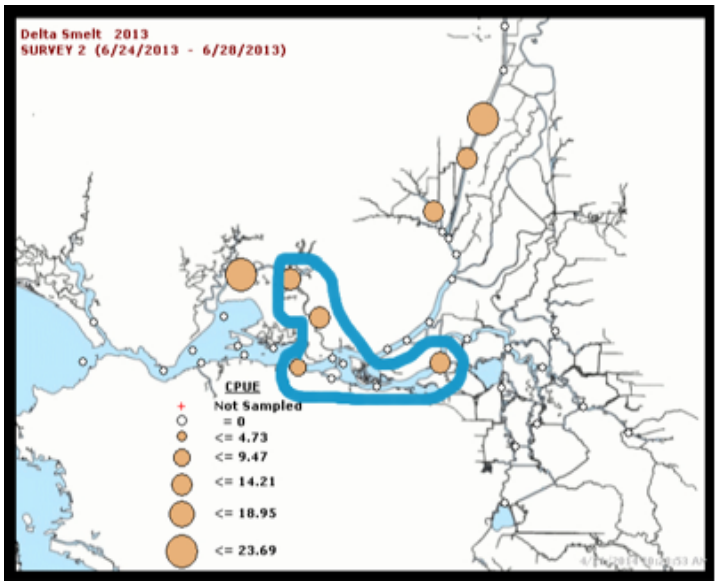

Figure 19. Summer Townet Survey for late June 2013. These are spring conditions just prior to summer conditions. Note LSZ (blue boundary) and Delta Smelt distribution. Delta inflows were rising from 12,000 to 17,000 cfs. Exports were rising from 4,000 to 6,000 cfs. Delta outflows were steady at 7,000-8,000 cfs.

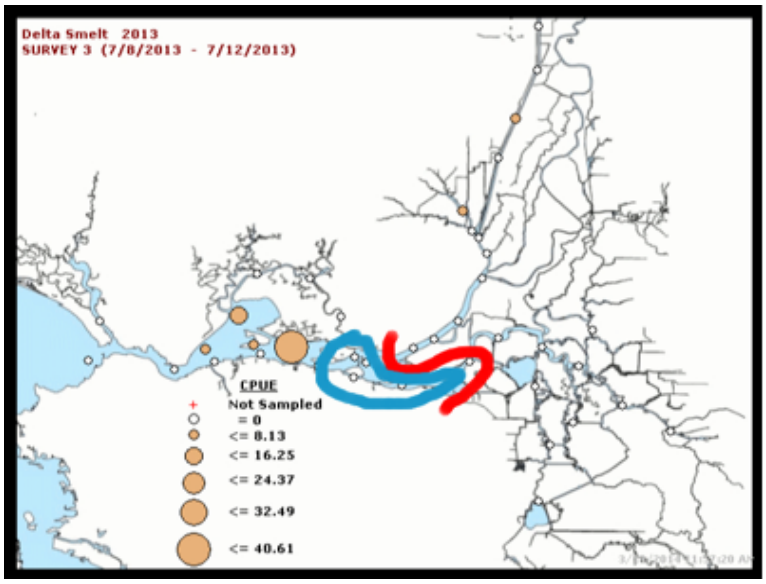

Figure 20. Summer Townet Survey for early July 2013. These are summer conditions just after spring conditions transitioned into summer. Note LSZ (blue boundary) and Delta Smelt distribution. Delta inflows had risen from 12,000 to 18,000 cfs (from reservoir releases for export). Exports had risen from 4,000 to 10,000 cfs. Delta outflows had fallen from 8,000 to 4,000 cfs. East of the red line water temperatures were greater than 23C, too high for Delta Smelt. Approximately 2/3rds of the warm inflow was going down the Sacramento River channel into eastern Suisun Bay. Surviving smelt were concentrated in western Suisun Bay in cooler slightly higher salinity brackish waters. Few smelt were observed in the warm waters of the Delta. Two locations in the north Delta with smelt were in deeper stratified waters of Cache Slough and the Deep Water Ship Channel.