United States Department of the Interior

BUREAU OF RECLAMATION
Central Valley Operations Office
3310 El Camino Avenue, Suite 300
Sacramento, California 95821

IN REPLY
REFER TO:

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Nat'l Marine Fisheries Svs.
Sacramento, CA
DOC # 00278

VIA ELECTRONIC MAIL ONLY

Ms. Maria Rea
Assistant Regional Administrator
California Central Valley Area Office
National Marine Fisheries Service
650 Capitol Mall, Suite 5-100
Sacramento, CA 95814

Subject: Contingency Plan for Water Year (WY) 2015 Pursuant to Reasonable and Prudent Alternative (RPA) Action I.2.3.C of the 2009 Coordinated Long-term Operation of the Central Valley Project (CVP) and State Water Project (SWP) Biological Opinion (NMFS 2009 BiOp)

Dear Ms. Rea:

By letter dated March 27, 2015, the National Marine Fisheries Service (NMFS) concurred that the Bureau of Reclamation's (Reclamation) and the Department of Water Resources' (DWR) Interim Contingency Plan for April - September 2015, is consistent with RPA Action I.2.3.C in NMFS' 2009 BiOp. Reclamation now requests concurrence from NMFS that the operations described in the attached *Updated Project Description for July - November 2015 Drought Response Actions to Support Endangered Species Act Consultations* (Project Description) are within the limits of the Incidental Take Statement of the BiOp and serves as the Contingency Plan through November 2015 in accordance with RPA Action I.2.3.C.

The Updated Project Description will serve as the drought contingency plan for the months of July through November 2015, and is consistent with the drought exception procedures outlined in RPA Action I.2.3.C of the NMFS 2009 BiOp. RPA Action I.2.3.C is triggered based on a February forecast showing that end of September Shasta storage will be less than 1.9 million acre feet (MAF), or that a Clear Creek temperature compliance point is not achievable. The April 2015 forecast shows Reclamation to be unable to meet 1.9 MAF at the end of September. In addition, projections for Trinity Reservoir indicate that the end of September storage may fall below 600 thousand acre feet (TAF).

As you are aware, California is experiencing unprecedented critically dry conditions in the current water year, following three previous dry years. As a result of this continued aridity, the CVP and the SWP reservoir levels were significantly below average in October at the beginning of water year (WY) 2015. The extreme lack of precipitation since early February 2015 has resulted in the State's overall water storage levels remaining far below average. Adequate storage is needed throughout the year and especially in dry times of the year in order for the CVP and SWP to supply human needs, continue repelling saltwater in the Delta, and provide for cold water needs of Chinook salmon, steelhead, and green sturgeon.

The enclosed Project Description, developed in coordination with DWR, the U.S. Fish and Wildlife Service (USFWS), NMFS, and the California Department of Fish and Wildlife (DFW), outlines proposed

actions and a likely range of coordinated operation of the CVP and SWP through November 30, 2015. Modifications of the enclosed Project Description could occur based on evolving information which could include conditions in the State Water Resources Control Board (State Board) regulatory approvals as well as federal Endangered Species Act (ESA) and California ESA requirements. Reclamation and DWR also intend to continue to refine operations of the CVP and SWP as hydrological and biological information become available, in coordination with federal and state resources agencies. If refinements or modifications are necessary that may change the effects to listed species, Reclamation will seek consultation with NMFS to address those potential effects.

In response to the water shortage crisis, Reclamation and DWR will be submitting a Temporary Urgency Change (TUC) Petition Regarding Delta Water Quality, requesting that the State Board temporarily modify requirements of D-1641 for up to 180 days, with specific requests for July through November to enable changes in operations that will provide supplies for minimum human health and safety and other critical needs, and conserve water for later protections of instream uses and water quality. As described in the Project Description, Reclamation and DWR are specifically requesting modification of the D-1641 Delta outflow requirements, Rio Vista flow requirements, and Western Delta salinity compliance point requirements (see enclosed Project Description for further details). These changes would reduce reservoir releases from those otherwise required to meet D-1641 from July through November to conserve storage for fishery protection, future minimum health and safety needs, and if necessary, salinity control. Reclamation is also requesting changes to the Ripon dissolved oxygen compliance point requirement, and extension of the water transfer window through November 15, 2015, to allow for the incremental conveyance of transfer water proposed to be retained in Shasta and Folsom reservoirs for diversion from the south Delta at the Jones Pumping Plant or Banks Pumping Plant. The incremental release of transfer water in the fall will both help improve in-stream fishery conditions and increase critical drought supplies south of the Delta. The incremental increase in pumping associated with the transfers will be above the reduced base Project operation limited by drought conditions, but is currently estimated to be above the rate needed to support minimum human health and safety. Additionally, Reclamation requests NMFS concurrence per RPA Action I.2.4 on the Sacramento River water temperature management plan as submitted to the State Board on May 4, 2015. The Project Description also includes identification of possible future conditions warranting additional modifications that may be implemented in 2015 to address the ongoing drought conditions. These include San Joaquin River at Vernalis flow requirements, San Joaquin River salinity requirements, and New Melones October pulse flow requirements. This request and the enclosed Biological Review do not cover those potential future requests.

Reclamation and DWR reviewed the effects of the specific request for July through November 2015 on listed species. The resultant Biological Review is enclosed. Based on the Biological Review, Reclamation believes that the effects of the actions requested for July through November on listed salmonids, green sturgeon, and their designated critical habitats will not result in violation of the incidental take limit in the NMFS 2009 BiOp, nor will these actions jeopardize the continued existence of the listed species or destroy or adversely modify their designated critical habitats.

As you are aware, DWR has initiated construction of an emergency drought barrier at West False River to address Delta salinity intrusion that would threaten drinking water quality and ongoing CVP/SWP operation if unexpected high tidal or unusual meteorological conditions occur. Emergency ESA consultation on construction and resultant operation of the CVP and SWP with the West False River barrier in place has been initiated and will be conducted under a separate process. Because the barrier will be in place during the operation described in the attached Project Description, both the Project

Description and associated Biological Review assume installation of an emergency drought barrier at West False River.

Similarly to 2014, Reclamation and DWR will continue close coordination on current and projected operations on a weekly basis through the Real-Time Drought Operations Management Team (RTDOMT) and other groups (Smelt Working Group, Delta Operations for Salmonids and Sturgeon technical work group, Delta Conditions Team, Water Operations Management Team, etc.). The RTDOMT was formed in 2014 and includes designated representatives from Reclamation, DWR, the State Board, DFW, NMFS, and USFWS. The RTDOMT has proven effective as a forum to discuss potential changes to SWP and CVP operations to meet health and safety requirements and to reasonably protect all beneficial uses of water. The RTDOMT will continue to meet at least weekly to ensure effective coordination among the pertinent agencies. The results of these efforts will inform both future determinations associated with the USFWS 2008 Coordinated Long-term Operation of the CVP and SWP Biological Opinion, the NMFS 2009 BiOp, and additional TUC petitions to the State Board, if necessary. Additionally, Delta Smelt and salmonid monitoring, as described in the *CVP and SWP Drought Contingency Plan, October 15, 2014 - January 15, 2015,* submitted to the State Board on October 15, 2014, will continue as needed to inform operational decisions.

The enclosed Biological Review supports Reclamation and DWR's conclusion that the effects associated with changes identified in the Project Description are within what was analyzed in the NMFS 2009 BiOp. Any incidental take resulting from these changes are within the existing incidental take limits in the NMFS 2009 BiOp. Because these actions are contemplated within the drought exception procedures described in the NMFS 2009 BiOp, they do not jeopardize the listed species or adversely modify or destroy designated critical habitats addressed in the NMFS 2009 BiOp. Reclamation seeks NMFS' concurrence in this determination.

We look forward to working with you and your staff as we navigate through another extremely challenging water year and appreciate your willingness to work with us on this time sensitive matter.

Sincerely,

Ronald Milligan

Ronald Milligan
Operations Manager

Enclosures - 2

cc: Mr. Tom Howard
Executive Director
State Water Resources Control Board
1001 I Street
Sacramento, CA 95814

Continued next page.

cc: Continued from Previous page.

Mr. Chuck Bonham
Director
California Department of Fish and Wildlife
1416 Ninth Street
Sacramento, CA 95814

Mr. Mark Cowin
Director
California Department of Water Resources
1416 Ninth Street
Sacramento, CA 95814

Mr. Larry Rabin
Acting Field Supervisor, Bay Delta Fish and Wildlife Office
U.S. Fish and Wildlife Service
650 Capitol Mall, Suite 8-300
Sacramento, CA 95814

Mr. Dean Messer
Chief, Environmental Services
California Department of Water Resources
P.O. Box 94836
West Sacramento, CA 94236-0001

Mr. John Leahigh
Operations Control Office
California Department of Water Resources
3310 El Camino Avenue, Suite 300
Sacramento, CA 95821

Mr. Ren Lohoefener
Regional Director
Pacific Southwest Region
U. S. Fish and Wildlife Service
2800 Cottage Way
Sacramento, CA 95825

Mr. David Murillo
Regional Director
Mid-Pacific Region
Bureau of Reclamation
2800 Cottage Way
Sacramento, CA 95825
(w/encl to each)

Attachment 1
Updated Project Description for July - November 2015 Drought Response Actions
To Support Endangered Species Act Consultations

In order to cope with a fourth consecutive year of drought and to prepare for the possibility of entering into a fifth year of drought, the Bureau of Reclamation (Reclamation) and the project applicant, the California Department of Water Resources (DWR), are considering additional temporary modifications to the operations of the Central Valley Project (CVP) and State Water Project (SWP). Coordinated long-term operation of the CVP and SWP previously underwent Endangered Species Act (ESA) consultation that resulted in biological opinions (BiOps) from the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) in 2008 and 2009, respectively.

Reclamation and DWR are currently operating the CVP and SWP in accordance with the USFWS and NMFS BiOps and the April 6, 2015, Temporary Urgency Change (TUC) Order issued by the Executive Director of State Water Resources Control Board (State Water Board). The April 6, 2015 TUC Order approved changes to license and permit terms and conditions requiring compliance with Delta water quality objectives in response to drought conditions through June 30, 2015. Reclamation determined that the changes to D-1641 would not have any additional effects to Delta Smelt beyond those analyzed in the 2008 BiOp. USFWS accepted this determination on March 27, 2015. Reclamation also determined that the changes to D-1641 were consistent with NMFS RPA Action I.2.3.C. NMFS concurred with this determination on March 27, 2015.

This updated Project Description describes the specific actions that Reclamation and DWR propose to implement from July through November 2015 related to changes in D-1641 standards in the Project Description of the 2008 and 2009 BiOps, as well as additional specific consultation requests not previously considered. These include changes to the Ripon dissolved oxygen compliance point requirement, and extension of the water transfer window through November 15, 2015. Additionally, Reclamation is requesting NMFS concurrence per RPA Action I.2.4 on the Sacramento River water temperature management plan as submitted to the State Board on May 4, 2015. Although not included in this proposed Project Description, the hydrologic modeling and associated Biological Review developed for ESA consultation associated with this Project Description assumed DWR's construction of an emergency drought barrier at West False River starting on May 7, 2015, with barrier removal completed by November 15, 2015.

Proposed July through November 2015 Actions

Reclamation and DWR are using the April 90% exceedance forecast for Central Valley hydrology for the purpose of ESA consultation to predict the actions that are necessary to modify the Project Description and Reasonable and Prudent Alternatives (RPAs) described in the 2008 and 2009 BiOps. Reclamation and DWR consider the April 90% exceedance a reasonable hydrologic estimate on which to base the ESA consultation. A summary of the April 2015 Operation Forecasts is included as Attachment A. As conditions change and develop, additional coordination with NMFS may be required to address any

adjustments to water temperature management on the upstream tributaries consistent with the RPA actions contained in the NMFS BiOp.

The following actions in July through November 2015 are proposed under a critically-dry hydrologic forecast, and may or may not be implemented depending on observed conditions and ability of DWR and/or Reclamation to obtain modifications to water rights permits.

I. Proposed Upstream Tributary Operations - July Through November 2015

A. Upper Sacramento River, Trinity River, and Clear Creek Flows and Temperature Management Planning – NMFS RPA Action I.2.3.C

Reclamation intends to integrate to the fullest extent possible the operations of the Trinity, Clear Creek, and Shasta reservoir complex to make maximum use of the limited cold water reserves in each reservoir. The highest priority for this ongoing cold water management will be to maintain cold water temperatures on the upper Sacramento River to protect the endangered Sacramento River winter-run Chinook salmon. Consideration will also be given to maintain conditions to protect spring-run Chinook salmon and steelhead in Clear Creek and Trinity River coho salmon.

In addition, the Sacramento River Settlement Contractors have agreed to shift a portion of their diversions this year out of the April and May period and into the time frame where Keswick releases are higher to achieve temperature objectives on the upper Sacramento River. The cooperation of the Settlement Contractors allows for a modified diversion pattern and creates the benefit of increased Shasta Reservoir storage early in the temperature control season. These assumptions are included in the Sacramento River water temperature management plan, operational forecasts, and associated Biological Review.

Trinity Operations

Reclamation is implementing the Trinity River Dry year flow schedule as recommended by the Trinity Management Council. As identified in the Trinity River Restoration Project Record of Decision (ROD) the flow schedule for the Trinity River is based on the April 1, 50% exceedance inflow forecast. Diversions from the Trinity River Division are necessary to support temperature operations for the Sacramento River and projections for Trinity Reservoir indicate that the end of September storage may fall below 600,000 acre-feet. Releases bypassing the penstock through the low level outlet at Trinity Lake will be implemented for temperature management if necessary to help meet species needs and State Water Board basin plan objectives. Pursuant to Government-to-Government obligations, Reclamation will continue to consult with Trinity Basin tribes.

Clear Creek Operations

The Clear Creek population of spring-run Chinook salmon is a necessary component of the species, and also provides an important buffer to other Central Valley populations, but the limited cold water

supplies this year, and the priority to protect winter-run Chinook salmon on the Sacramento River, may limit the ability to manage temperatures and flows on Clear Creek.

Water temperatures on Clear Creek could be managed at either an alternate compliance point or by modifying the temperature objective at Igo. Potential operational changes would be discussed by the Clear Creek Technical Team (CCTT) and/or Sacramento River Temperature Task Group (SRTTG), as appropriate. Recommendations on how to manage Clear Creek temperature objectives would be advanced to NMFS, the Water Operations Management Team (WOMT) and the Real-Time Drought Operations Management Team (RTDOMT) for consideration. Management decisions would be based on updated temperature modeling results from monthly forecast updates through the temperature control season as applicable.

Shasta Operations/Keswick Release Schedule

A major goal for Shasta Reservoir operations has been to conserve as much storage as possible during the winter and spring of 2015 to provide cold water for salmonids later in the 2015 water year, and provide carryover storage for water year 2016. This is especially important in the event that the current prolonged drought continues until next year.

Given the severe drought conditions and limited availability of cold water resources this year, and consistent with NMFS RPA Action I.2.3.C, this updated Project Description incorporates the following operational actions in the July through November period:

- Keswick releases will not be increased to directly support CVP or SWP Delta diversions;
- Reclamation and DWR have worked with the State Water Board to modify a number of water quality and flow standards (see Section II.A, below, for details) that help limit the need for increased Keswick releases to meet Delta objectives. Reclamation will continue to rely on other CVP reservoirs to the extent possible to meet overall CVP obligations;
- Reclamation will bypass the power penstocks at times this year if such operation will help access remaining cold water pool or would help preserve cold water if blending with warmer water early in the season is appropriate to meet overall CVP obligations;
- In coordination with the Sacramento River Settlement Contractors, Reclamation will facilitate water transfers to improve the Sacramento River temperature operations. This will include reduced diversions from the Sacramento River and conserving Shasta Reservoir storage in the spring and releasing the water from Shasta Reservoir for Project and transfer purposes later in the summer and fall;
- Reclamation will coordinate with the Sacramento River Settlement Contractors to minimize the impact of diversions for rice decomposition on Shasta Reservoir operations; and

- Reclamation will continue to develop monthly operational forecasts and temperature analyses to facilitate the ongoing monthly consultation under NMFS RPA Action I.2.4.

The attached operational forecasts (see Attachment A) were developed, in part, using the estimated Sacramento Valley depletion forecasts calculated by DWR as part of their monthly hydrologic updates as updated to reflect anticipated operations by the Sacramento River Settlement Contractors and adjusted Keswick releases in September through mid-November.

Based on current projected inflow data and in-basin depletions, productive discussions with Sacramento River Settlement Contractors, and other parameters outlined above, an estimate of average monthly releases from Keswick Reservoir are presented below.

Average Monthly Keswick Reservoir Release
(in cubic feet per second)

May	7,500
June	8,500
July	9,000
August	8,500
September	6,500
October	5,000
November	4,000
December	4,000

To help reduce effects on both winter-run and fall-run Chinook salmon this year, the actual real-time Keswick releases may be adjusted based on observed conditions and coordination with the resource agencies through the RTDOMT. Several key areas of focus are summarized below:

- The maximum Keswick release in July will be kept at or below 9,000 cfs based on Delta and Sacramento River conditions, but the average release in July will be kept between 8,500 and 9,000 cfs, as conditions allow;
- The Keswick release around the beginning of September will be closely correlated to the monitoring of winter-run redds, which will likely be influenced by the average July flow rate. This flow rate is currently estimated to be between 6,000 and 6,500 cfs, lasting to about mid-October;
- The timing and target flow rate in mid-October will be based on winter-run redd monitoring and actual Shasta Lake levels, and is currently estimated to be 4,000 cfs;
- The key flow reductions and ramp down rates in September and October will be closely monitored and coordinated with field crews on the Sacramento River to minimize the potential for redd dewatering and/or stranding.

- The Keswick release in the October through December period will be scheduled to facilitate transfer water that was conserved earlier in the summer to improve temperature operations on the Sacramento River. Releases will be made above the base flow of 3,250 cfs in this period for transfers and to reduce impact to spawning fall-run Chinook salmon. The release is currently estimated to be about 4,000 cfs in November and December.

The cold water and flow management of Shasta, Trinity and Whiskeytown reservoirs will be carried out in coordination with the SRTTG to meet temperature objectives on the Sacramento River, Clear Creek, and the Trinity River, to minimize redd dewatering, or isolation or stranding of salmonids, and to meet in-basin water supply needs. The temperature operations will be conducted in accordance with Water Rights Order 90-05. Reclamation will provide the SRTTG with additional modeling as requested based on shaping of delivery schedules in addition to temperature release locations in order to extend the duration of cold water availability into the fall with a goal, because of uncertainties in forecasting, of October. Per the RPA, Reclamation will by-pass power generation to improve temperatures if needed for the protection of winter-run and/or spring-run Chinook salmon.

As required by the NMFS BiOp, operations of other CVP reservoirs will be scheduled to support Shasta Reservoir cold water pool needs to the extent possible, provided such action would not unnecessarily cause other significant adverse fishery effects.

The SRTTG will continue to meet and provide advice on how to best meet temperature objectives to WOMT and RTDOMT based on updated temperature modeling results from monthly forecast updates through the temperature control season as applicable. The ultimate goal will be to balance the various factors to provide the best possible, given the constraints, conditions on the Sacramento River for winter-run Chinook salmon.

B. Folsom/American River Operations

Per the Flow Management Standard (FMS) included in the NMFS BiOp, the projected March through November unimpaired inflow to Folsom Reservoir of less than 400,000 acre-feet has resulted in water year 2015 being a conference year. Under these conditions, flows may be reduced to the minimum flows as identified in the FMS and consistent with D-893 (i.e., 250 cfs through September 15 at Nimbus Dam) to help conserve Folsom Lake storage. Minimum flows will be based on continuing discussions between Reclamation, the Water Forum, the American River Group, and state and federal fishery agencies. To comply with NMFS RPA Action II.2, Reclamation will be submitting the Operations Forecast and Temperature Management Plan to NMFS in May 2015 and will continue to coordinate closely with NMFS and the American River Group as conditions materialize to address temperature considerations on the American River. As noted above, Reclamation will continue to rely on CVP reservoirs (e.g., Folsom Reservoir) to the extent possible to support Shasta Reservoir cold water pool needs and to meet overall CVP obligations.

C. New Melones/Stanislaus River Operations

The estimated flow schedule for the Stanislaus River is shown in Attachment A. Reclamation is currently estimating that projected inflows would allow for release of the required Appendix 2-E base through September per NMFS RPA Action III.1.3. However inflow forecasts are trending downward and available supplies for release of the October pulse flow volume may need to be adjusted based on observed conditions later in the summer (see Section II.C: Other Provisions, Possible Future Conditions Warranting Additional Modifications below). Once the available volumes are confirmed, the timing of releases of fall flows will be coordinated with the Stanislaus Operations Group (SOG), with consideration of the other flow actions in the San Joaquin River basin this fall.

D. Feather River Operations

DWR plans to meet all flow requirements on the Low Flow Channel and High Flow Channel on the Feather River and all temperature requirements at the Feather River Fish Hatchery and Robinson's Riffle for all periods as designated in the current FERC license which includes consultation by NMFS and USFWS, and the 1983 agreement between DWR and CDFW.

II. Proposed Modifications to Delta Operations - July Through November 2015

A. D-1641 Provisions

Modification of Net Delta Outflow Index

D-1641 requires a Delta outflow minimum monthly average Net Delta Outflow Index (NDOI) of 4,000 cfs 3-day average during the month of July. Reclamation and DWR are petitioning the State Water Board to adopt a Delta outflow standard of a minimum monthly NDOI during July to be no less than 3,000 cfs. The 7-day running average shall be no less than 1,000 cfs below the monthly average.

Modification of Rio Vista Flow Requirement

D-1641 Table 3 dictates a minimum monthly Sacramento River flow requirements measured at Rio Vista of 3,000 cfs in the months of September and October, and 3,500 cfs in November (for critically dry water years). This requirement also states that the 7-day running average Sacramento River flow measured at Rio Vista shall be no lower than 2,000 cfs during this time. Reclamation and DWR are petitioning the State Water Board to modify the D-1641 Table 3 Sacramento River at Rio Vista flow requirements to be no less than 2,500 cfs on a monthly average in September, October and November. The 7-day running average shall not be less than 2,000 cfs.

Modification of Western Delta Salinity Compliance Point

In a critical year, D-1641 requires the Agricultural Western Delta Salinity Standard at Emmaton have a 14-day running average of 2.78 millimhos per centimeter from April 1 to August 15. Reclamation and DWR petitioned the State Water Board to modify this requirement by moving the compliance

location from Emmaton to Three Mile Slough on the Sacramento River beginning April 1 and the Board approved this modification through June 30, 2015. Reclamation and DWR are petitioning to renew this modification for July 1 through August 15, 2015.

B. NMFS and USFWS BiOp Provisions

Extension of Water Transfer Window

The 2008 biological assessment on the coordinated long-term operation of the CVP and SWP includes a water transfer window of July through September of each year. Reclamation is facilitating transfers up to 200 thousand acre feet (TAF) in coordination with operations to improve temperature operations on the Sacramento River. It is anticipated that much of the 200 TAF volume will be transferred within the normal July through September period, but potentially as much as 100 TAF may extend beyond September. To accommodate this remaining transfer volume, Reclamation is requesting an extension of the water transfer window through November 15, 2015 to allow the conveyance of up to approximately 100 TAF of transfer water (excluding carriage water) that will have been retained in Shasta and Folsom reservoirs for diversion from the south Delta at the Jones Pumping Plant or Banks Pumping Plant. It is estimated that up to 15 individual transfers will occur and the timing of each transfer will depend on the conditions (such as OMR flows) that exist at the time. Increased Delta outflow over the forecasted amounts shown in Attachment A may be realized due to carriage losses that are assumed to be necessary to maintain D-1641 Delta water quality requirements. Existing RPA Actions that may reduce or suspend conveyance of transfer water while fish movement is assessed will remain in effect (e.g., NMFS RPA Action IV.1.1, monitoring and alerts to trigger changes in Delta Cross Channel operations; and NMFS RPA Action IV.3, reducing likelihood of entrainment or salvage at the export facilities). Reclamation is committed to continue close coordination with USFWS and NMFS as water transfers are planned and implemented.

C. Other Provisions

Ripon Dissolved Oxygen Compliance Point

State Water Board D-1422 requires that water be released from New Melones Reservoir to maintain a dissolved oxygen (DO) concentration in the Stanislaus River as specified in the Water Quality Control Plan (WQCP) for the Sacramento and San Joaquin river basins. The 1995 revision to the WQCP established a minimum DO concentration of 7 milligrams per liter (mg/l), as measured on the Stanislaus River near Ripon. In coordination with Reclamation's plan of operation for New Melones Reservoir, Reclamation will petition the State Water Board to modify this requirement to maintain a minimum DO concentration of 5 mg/l at Ripon. This request will be processed through a future TUC petition to the State Water Board separate from Reclamation and DWR's TUC petition addressing proposed modifications to D-1641 detailed above (see Section A. D-1641 Provisions).

Actions Proceeding Under Separate Consultation

West False River Emergency Drought Barrier: DWR has initiated construction of an emergency drought barrier using rock (rip-rap) at West False River. The West False River emergency drought barrier is necessary to address Delta salinity intrusion that would threaten drinking water quality and ongoing CVP/SWP operation if unexpected high tidal or unusual meteorological conditions occur. Hydrologic forecasts and operational experience have shown that there is insufficient water in upstream reservoirs to repel saltwater and meet health and safety and other critical needs this year. In addition, Delta export pumping will be reduced this summer to the point that it cannot be used to support Delta salinity management. Excessive salinity increases in the Delta could render the water undrinkable for people who live in the Delta; Contra Costa, Alameda, and Santa Clara counties; and the 25 million people who rely on the Delta-based federal and state water projects for at least some of their water supplies. DWR is constructing an emergency drought barrier to minimize these threats.

In-water construction of the West False River emergency drought barrier began on May 6, 2015, and is scheduled to be completed by June 22, 2015. Removal of the West False River barrier will be initiated in late September/early October and be completed by November 15, 2015. Emergency ESA consultation on construction of this emergency drought barrier and resultant operation of the CVP and SWP with the barrier in place has been initiated and will be conducted under a separate process.

Possible Future Conditions Warranting Additional Modifications

The description below is included to highlight specific actions and factors that may be considered throughout the remainder of 2015, and identifies actions that may be included in future ESA consultations, if necessary. This is not intended to be a fully inclusive list of potential actions, nor does inclusion below mean the agencies will go forward with any of these actions.

San Joaquin River Flow: Table 3 of D-1641 specifies San Joaquin River at Airport Way Bridge, Vernalis minimum monthly average flows during October of 1,000 cfs. Reclamation and DWR do not anticipate the need for any modification of this objective, but will monitor and evaluate San Joaquin River flow conditions through the summer. As noted in footnote 1 on page 3 of the Biological Review, an October fall pulse flow was not included in the modeling completed for the Biological Review for either the baseline or proposed action scenarios. A baseline flow of 1,000 cfs will be used to evaluate any modification to the October Vernalis flow requirement, if that modification is deemed necessary based on late-summer New Melones Reservoir storage.

San Joaquin River Salinity Requirement: In all water year types, D-1641 requires a San Joaquin River at Vernalis salinity limit of 0.7 EC from April through August. Based on observed conditions last year, Reclamation does not anticipate the need to modify the Vernalis salinity objective at this time, but will continue to monitor and evaluate conditions through the year.

New Melones October Pulse Flow: NMFS RPA Action III.1.3 requires release of Appendix 2-E pulse flows in October, however inflow forecasts are trending downward and available supplies for release of the October pulse flow volume may need to be adjusted based on observed conditions later in the summer. Once the available volumes are confirmed, the timing of releases of fall flows will be coordinated with the Stanislaus Operations Group (SOG) and RTDOMT, with consideration of the other flow actions in the San Joaquin River basin this fall. If volumes are not sufficient to meet Appendix 2-E pulse flows, Reclamation may need to request modification of this RPA action.

Attachment A

April 2015 Operational Forecasts

Estimated CVP Operations Assuming April 90% Exceedance Runoff and Coordination with Upstream Operations

Storages

Federal End of the Month Storage/Elevation (TAF/Feet)

		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Trinity	**1191**	**1185**	**1017**	**883**	**760**	**635**	**545**	**514**	**482**	**466**			
	Elev.	2275	2257	2241	2225	2207	2193	2187	2181	2178			
Whiskeytown	**205**	**238**	**238**	**238**	**238**	**238**	**230**	**206**	**206**	**206**			
	Elev.	1209	1209	1209	1209	1209	1207	1199	1199	1199			
Shasta	**2689**	**2648**	**2352**	**2050**	**1688**	**1368**	**1161**	**1080**	**1089**	**1115**			
	Elev.	992	977	960	938	916	899	893	893	895			
Folsom	**572**	**573**	**536**	**437**	**305**	**250**	**215**	**201**	**196**	**199**			
	Elev.	425	421	408	388	378	370	367	366	367			
New Melones	**553**	**489**	**417**	**336**	**254**	**183**	**141**	**104**	**94**	**83**			
	Elev.	855	839	818	794	769	751	733	727	721			
San Luis	**395**	**378**	**318**	**248**	**132**	**80**	**204**	**370**	**449**	**605**			
	Elev.	473	455	427	383	349	367	396	423	459			
Total		5512	4878	4191	3376	2753	2496	2475	2516	2673			

State End of the Month Reservoir Storage (TAF)

Oroville	**1794**	**1783**	**1664**	**1487**	**1271**	**1102**	**1016**	**1006**	**898**	**843**		
	Elev.	761	749	729	702	679	667	665	648	639		
San Luis	**959**	**846**	**706**	**507**	**265**	**103**	**79**	**118**	**271**	**453**		
Total San Luis (TAF)	**1354**	**1224**	**1024**	**754**	**397**	**183**	**283**	**488**	**720**	**1058**		

Monthly River Releases (TAF/cfs)

Trinity	TAF	32	180	47	28	28	27	23	18	18			
	cfs	**540**	**2,924**	**783**	**450**	**450**	**450**	**373**	**300**	**300**			
Clear Creek	TAF	13	13	9	7	5	9	11	10	11			
	cfs	**218**	**216**	**150**	**120**	**85**	**150**	**175**	**175**	**175**			
Sacramento	TAF	256	461	506	553	523	387	307	238	246			
	cfs	**4300**	**7500**	**8500**	**9000**	**8500**	**6500**	**5000**	**4000**	**4000**			
American	TAF	30	86	114	147	79	54	49	48	49			
	cfs	**500**	**1397**	**1910**	**2387**	**1288**	**902**	**803**	**807**	**800**			
Stanislaus	TAF	30	9	9	9	9	9	35	12	13			
	cfs	**500**	**150**	**150**	**150**	**150**	**150**	**577**	**200**	**206**			
Feather	TAF	48	55	116	158	123	101	58	57	58			
	cfs	**800**	**900**	**1950**	**2575**	**2000**	**1700**	**950**	**950**	**950**			
WLK		3722	3716	3800	3787	4340	4753	4425	4107	4960			

Trinity Diversions (TAF)

	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Carr PP	39	22	97	98	97	62	15	28	19			
Spring Crk. PP	**8**	**15**	**90**	**90**	**90**	**60**	**30**	**19**	**12**			

Delta Summary (TAF)

		Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Tracy		42	43	47	22	50	184	208	97	173			
USBR Banks		0	0	0	0	0	0	0	0	0			
Contra Costa		8.7	8.7	8.7	8.0	8.3	8.7	3.5	4.3	4.7			
Total USBR		50	52	56	30	58	193	212	101	178			
State Export		33	18	29	30	30	48	77	173	209			
Total Export		83	70	85	60	88	241	289	274	387			
COA Balance		0	1	-1	0	-1	0	0	0	0			
Old/Middle River Std.													
Old/Middle R. calc.		-1,220	-1,177	-1,498	-1,149	-1,527	-3,510	-3,696	-3,793	-5,099			
Computed DOI		4253	4002	4001	2993	2993	3009	2993	3496	3497			
Excess Outflow		252	0	0	0	0	0	0	0	0			
% Export/Inflow		19%	15%	15%	10%	16%	41%	51%	52%	64%			
% Export/Inflow std.		35%	35%	35%	65%	65%	65%	65%	65%	65%			

Hydrology

	Trinity		Shasta		Folsom		New Melones	
Water Year Inflow (TAF)	893		3,467		847		293	
Year to Date + Forecasted % of mean	74%		63%		31%		28%	

CVP actual operations do not follow any forecasted operation or outlook; actual operations are based on real-time conditions.
CVP operational forecasts or outlooks represent general system-wide dynamics and do not necessarily address specific watershed/tributary details.
CVP releases or export values represent monthly averages.
CVP Operations are updated monthly as new hydrology information is made available December through May.

Methods and Modeling

Conceptual Model

Four Chinook salmon runs, which are differentiated by the timing of the adult spawning migration (fall-run, late-fall-run, winter-run, and spring-run) are found in the Central Valley. NMFS (64 FR 50394) determined the four Central Valley Chinook salmon races comprise three distinct Evolutionarily Significant Units (ESUs): the fall/late fall-run, the spring-run, and the winter-run. The Sacramento River winter-run Chinook Salmon ESU is restricted to a single population. The Central Valley spring-run Chinook Salmon ESU is comprised of multiple self-sustaining wild populations (Mill, Deer and Butte Creek), although additional spring-run Chinook salmon populations exist in the mainstem Sacramento River, Feather River and Clear Creek. All these species share similar life stages, biological responses to habitat attributes, and exposure to environmental and management drivers (Figure 1).

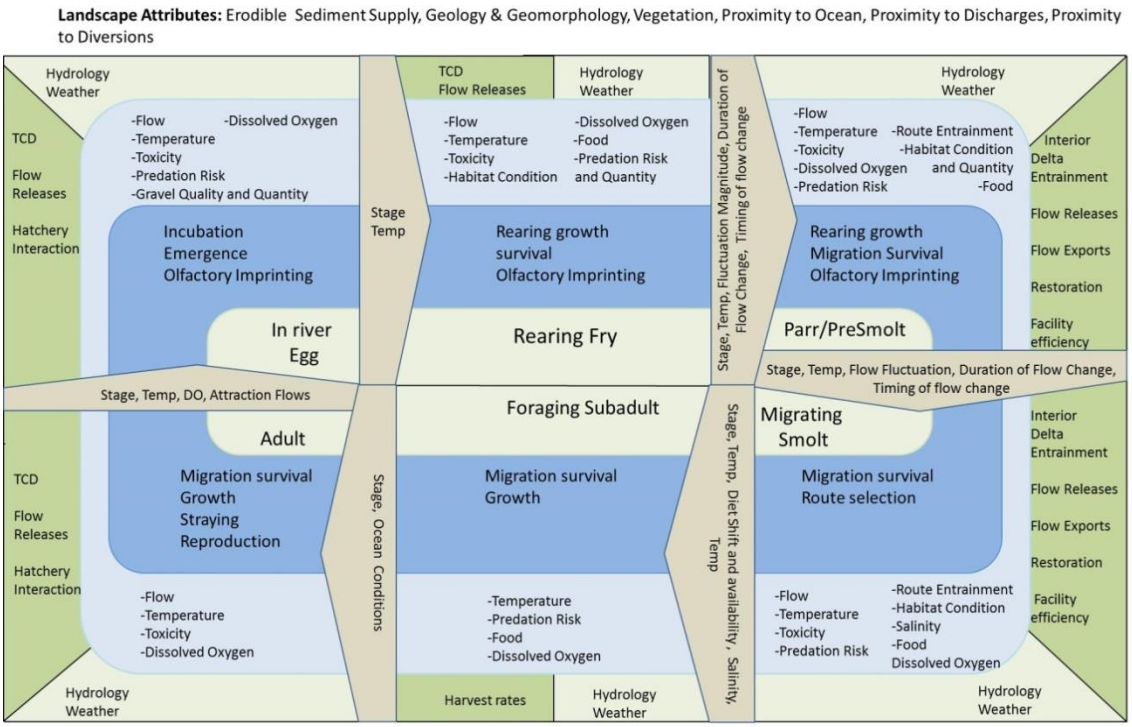


Figure 1. Conceptual Model for Central Valley Salmonids. The center are life stages nested in tiers representing biological responses, habitat attributes, and environmental and management drivers. Landscape attributes are representative of spatially diverse characteristics that can modify habitat attributes regionally. The grey arrows across tiers linking life stages represent transitional habitat attributes.

Egg Mortality Model

Egg and juvenile mortality can be estimated using a dynamic simulation framework developed by Cramer Fish Science (CFS 2010) to estimate juvenile WRCS production. Relationships for daily mortality of incubating eggs and rearing juveniles (Bartholow and Heasley 2006) are parameterized with results from temperature mortality studies undertaken by USFWS (1999). Carcass data from 2007-2013 were used to model average spawning time, in which the date of egg deposition was shifted 14 days before a carcass was observed (K. Niemela, pers comm in CFS 2010). Thus, daily cohorts of incubating eggs experience the observed temperature and flow conditions. The model used observed daily flows measured at Freeport during WY 2014 and temperatures from the May 2015 temperature management plan (USBR 2015a) to estimate egg survival and egg to fry survival. The model runs on a daily time step, and a mean proportional mortality of the incubating eggs is estimated from the daily water temperature using a polynomial daily mortality relationship. A mean mortality of rearing juveniles is predicted from the daily water temperature using an exponential relationship. The model was run for 1000 iterations and the predicted mean survivals are reported for egg and fry life stages. This prediction is compared to predictions from the WY 2014 temperature management plan (USBR 2014).

There remains uncertainty with the results from this model of egg and egg-to-fry mortality. In 2014, the observed temperature difference between Keswick and Clear Creek was 1.3°F, which is not observed in the modeled results of Clear Creek and Keswick temperatures. Additionally, modeled egg and egg-to-fry mortality has never been as high as estimates of mortality based on observed juvenile production at Red Bluff Diversion Dam. It is not assumed that all mortality of these life stages is directly linked to temperature mortality, and Reclamation (2105b) suggested that the monitoring strategy consider indirect effects, potentially linked to temperature (such as increased predation mortality, increase disease mortality, and increased stranding mortality) to understand multiple stressors of the drought mediated by temperature. Additionally, there is uncertainty due to the potential for actual operations during late summer deviating from the temperature management plan if actual storage and temperature conditions in Trinity and Shasta reservoirs are different from the modeled conditions.

DSM2 Model

To model the Delta flows, water levels, and salinity, Delta models such as DSM2 need boundary inflows, exports, diversions, consumptive use diversions and returns, water levels, and salinity. For inflows to and exports from the Delta, the models use forecasted flows extracted from the Delta Coordinated Operations (DCO) studies that DWR's Division of Operation and Maintenance (O&M) and USBR conducts to determine State Water Project and Central Valley Project

allocations. DCO studies incorporate hydrology data, contractor delivery requests, and regulatory and court restrictions on exports[1]. The DCO allocation forecasts that were used for this analysis assumed a 90% hydrology. This forecast, which included the West False River Barrier, was compared to scenarios of meeting D1641 without modifications after the expiration of the current order and augmented Sacramento River flow as-needed at the expense of upstream storage, cold water pool and contract quantities (Table 1, Table 2). Scenarios of the 90% forecast with and without the West False River Emergency Drought Barrier (EBD) were also conducted for EC and flow at compliance points throughout the Delta (Table 1, Table 3). Projected salinity and flow patterns should be considered to reflect the relative influence of the proposed modifications, rather than as accurate predictions. A 90% hydrology is one that assumes, based on historical statistics, only one in ten years would be drier than this forecast. The models also use observed historical data up until the forecast period begins.

Table 1. Modeled conditions for DSM2 modeling. Red numbers in parentheses represent negative values.

April 90% D1641								
	Sacramento River (cfs)	San Joaquin River (cfs)	East Side Flow (cfs)	DCU (cfs)	CVP (cfs)	CCFB(cfs)	CCWD (cfs)	North Bay (cfs)
May-15	6,584	309	179	2,163	537	211	65	96
Jun-15	8,315	319	185	3,682	555	202	67	25
Jul-15	8,822	260	179	4,341	537	65	65	55
Aug-15	8,023	309	179	3,772	537	65	65	16
Sep-15	8,219	387	185	2,471	2,403	50	67	8
Oct-15	6,582	244	210	1,447	748	374	65	7
Nov-15	7,533	957	260	756	1,091	755	67	2

April 90% with TUCP with 1 EDB								
	Sacramento River (cfs)	San Joaquin River (cfs)	East Side Flow (cfs)	DCU (cfs)	CVP (cfs)	CCFB (cfs)	CCWD (cfs)	North Bay (cfs)
May-15	6,586	309	179	2,163	537	211	65	96
Jun-15	8,029	319	185	3,682	555	202	67	25
Jul-15	7,626	260	179	4,341	537	65	65	55
Aug-15	6,970	309	179	3,772	537	65	65	16
Sep-15	7,429	387	185	2,471	2,403	50	67	8
Oct-15	6,620	244	210	1,447	748	374	65	7
Nov-15	7,533	957	260	756	1,091	755	67	2

Comparison of "April 90% with TUCP + D1641" and "April 90% with TUCP" (the later minus former)								
	Sacramento River (cfs)	San Joaquin River (cfs)	East Side Flow (cfs)	DCU (cfs)	CVP (cfs)	CCFB(cfs)	CCWD (cfs)	North Bay (cfs)
May-15	2	0	0	0	0	0	0	0
Jun-15	(286)	0	0	0	0	0	0	0
Jul-15	(1,196)	0	0	0	0	0	0	0
Aug-15	(1,053)	0	0	0	0	0	0	0
Sep-15	(791)	0	0	0	0	0	0	0
Oct-15	37	0	0	0	0	0	0	0
Nov-15	0	0	0	0	0	0	0	0

[1] [1] As noted in the Project Description, Reclamation is not requesting a modification to the October Vernalis flow requirement per D-1641 at this time, so that action is not being evaluated in this document. A October fall pulse flow was not included in the modeling (both baseline and proposed action scenarios). A baseline flow of 1,000 cfs will be used to evaluate any modification to the October Vernalis flow requirement, if that modification is deemed necessary based on late-summer New Melones storage.

Table 2. Daily average flow and EC at compliance locations throughout the Delta for D-1641 and with 1 barrier DSM2 and DSM2-QUAL modeling.

Location	Daily Average flow	Daily average EC
	D-1641 v. 1 Barrier	D-1641 v. 1 Barrier
Jersey Point	1 barrier has smaller max and min daily flows (few 100 cfs difference)	1 barrier has greater EC (>500 umhos/cm difference)
Antioch	1 barrier has smaller max and min daily flows (few 100 cfs difference)	1 barrier has greater EC (>500 umhos/cm difference)
Rio Vista	1 barrier has smaller max flow and greater min flow (few to many 100 cfs difference)	1 barrier has greater EC (few 100 umhos/cm difference)
Old and Middle River	1 barrier has smaller max and min daily flows (~100 cfs difference)	1 barrier has greater EC (>500 umhos/cm difference)
Emmaton	1 barrier has smaller max flow and greater min flow (few to many 100 cfs difference)	1 barrier has greater EC (>500 umhos/cm difference)
Collinsville	1 barrier has smaller max flow and greater min flow (few to many 100 cfs difference)	1 barrier has greater EC (~1,000 umhos/cm difference)
Cache Slough near Ryer Island	1 barrier does not change max flow and greater min flow (few 100 cfs difference)	1 barrier has greater EC (<100 umhos/cm difference)
Vernalis	1 barrier does not change max and min flow	1 barrier does not change EC
Barker Slough (NBA Pumping)	N/A	1 barrier has greater EC (<50 umhos/cm difference)
Three Mile Slough	N/A	1 barrier has greater EC (>500 umhos/cm difference)
Rock Slough (CCWD Pumping)	N/A	1 barrier has lower EC for half of operational period, then higher EC for second half (<100umhos/cm difference)
Prisoners Point	N/A	1 barrier has greater EC (~100 umhos/cm difference)

Table 3. Daily average flow and EC at compliance locations throughout the Delta for the with and without 1 barrier DSM2 and DSM2 QUAL modeling.

Location	Daily Average flow	Daily average EC
	No barrier v. 1 barrier	No barrier v. 1 barrier
Jersey Point	1 barrier has smaller max and min daily flows (few 100 cfs difference)	1 barrier does not change EC consistently
Antioch	1 barrier has smaller max and min daily flows (few 100 cfs difference)	1 barrier consistently lower EC (~100 umhos/cm)
Rio Vista	1 barrier has smaller max flow and greater min flow (~100 cfs difference)	1 barrier consistently greater EC (~100 umhos/cm)
Old and Middle River	1 barrier has smaller max and min daily flows (<100 cfs difference)	Not completed
Emmaton	1 barrier does not change max flow and smaller min flow (~100cfs difference)	1 barrier consistently lower EC (~100 umhos/cm)
Collinsville	1barrier has smaller max flow and greater min flow (~100 cfs difference)	1 barrier consistently lower EC (~100 umhos/cm)
Cache Slough near Ryer Island	1 barrier has greater max flow and min flow (~100cfs difference)	1 barrier consistently greater EC (<50 umhos/cm)
Vernalis	1 barrier does not change max and min flow	1 barrier does not change EC
Barker Slough (NBA Pumping)	N/A	1 barrier consistently lower EC (~200 umhos/cm)
Three Mile Slough	N/A	1 barrier consistently greater EC (<100 umhos/cm)
Rock Slough (CCWD Pumping)	N/A	1 barrier consistently lower EC (>200 umhos/cm)
Prisoners Point	N/A	1 barrier consistently lower EC (<100 umhos/cm)

Biological Review of Winter-run Chinook Salmon

Updated Status of Winter-run Chinook Salmon

An updated status of Winter-run Chinook Salmon through April 21 is well-described in the Emergency Drought Barrier Aquatic Biological Assessment (DWR 2015, Environmental Baseline section). Based on daily monitoring data through May 5, 2015 the Delta Operation for Salmonids and Sturgeon (DOSS) work team believes that few (<1%) juvenile Brood Year 2014 Winter-run Chinook salmon remain upstream of or in the Delta and the majority (>99%) have migrated out of the Delta[2]. No salvage of juvenile Winter-run Chinook Salmon has occurred since March 31, 2015. The Sacramento River Temperature Task Group is monitoring the results of California Department of Fish and Wildlife winter-run Chinook carcass surveys. Historic information suggests less that 10% of carcasses are observed by the end of May based on data collected between 2003-2014, with a substantial increase in carcasses during the first three weeks of June (Figure 2). Spawning has started later during the last four years compared to previous survey years.

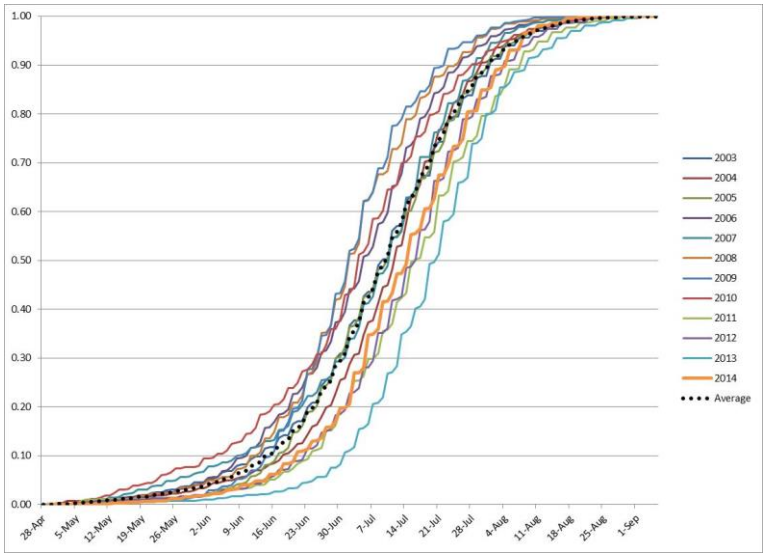


Figure 2. Temporal distribution of Winter run Chinook Salmon carcass survey between 2003 and 2014. Carcass recovery may be assumer to occur 2 weeks following spawning (K. Niemala in CFS 2009)

[2] [2] May 5, 2015 DOSS notes available at: http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/ocapwy2015.html

Effects of Project Description on Winter-run Chinook Salmon

Table 4: Presence of Winter run Chinook Salmon During the Project Description Period and Exposure to Potential Effects

Winter-run Chinook Salmon Life Stage	Life Stage Present	Tributary Habitat Effect	Delta Habitat Effect	Facility Loss Effect
Egg/Alevin	This life stage will be present in the Sacramento River May through September for BY 15.			
Sacramento R	Yes	Yes	N/A	N/A
Juvenile	This life stage will be present in the Sacramento during August to November for BY 15, and potentially present in the Delta in October and November			
Sacramento R	Yes	Yes	N/A	N/A
Delta	Potentially	N/A	No	No
Adults	This life stage will be present in the Sacramento River through July			
Sacramento R	Yes	Yes	N/A	N/A

Proposed Upstream Tributary Operations- July Through November

Winter-run Chinook salmon adults, eggs, and juveniles will be affected by the proposed operations (Table 4). CDFW and USFWS will conduct regular carcass surveys and aerial redd surveys during the summer 2015. Surveys will be conducted in close proximity to spawning areas and will enable an assessment of egg and alevin survival. CDFW and NMFS have monitoring and research studies planned to document and describe water quality around redds more accurately. A recent review of WY 2014 drought monitoring suggested monitoring of disease and pathogen during period of suboptimal water quality (Reclamation 2015c) would provide additional information to managers about undocumented sources of mortality, which are not accounted for in the mortality modeling. These undocumented sources of mortality may be the mechanisms influencing negative bias in models used for evaluating egg and egg to fry mortality in Winter-run Chinook Salmon.

Discussions on fish distribution and temperature management will occur throughout the year in the Sacramento River Temperature Task Group to iteratively inform and update temperature control operations. Based on the April 2015 Preliminary Temperature Analysis, the Project Description's model run met a temperature target of 56°F, with a few exceedances, at the Sacramento River above Clear Creek location through October. Based on the uncertainty of observations of Sacramento River temperature at the Clear Creek location (in WY2014, observed temperature differences between Keswick and Clear Creek were 1.3°F greater than the model difference), more numerous exceedances of

56°F are predicted to be observed. This model run estimated the end of September lake volume below 56°F to be approximately 340 TAF. For comparison , the 2014 April 90% operational forecast's temperature model run predicted end of September to be approximately 150 TAF, suggesting this year's plan may result in later operation of the temperature control device's (TCD's) side gate, which decreases the risk associated with temperature control through the TCD (USBR 2015a). As mentioned in the Method section, the temperature mortality model appears to underpredict mortality of egg and fry. There is uncertainty if this is related to sources of mortality not directly estimated by the model, actual operations during late summer deviating from the temperature management plan, and actual storage and temperature conditions in Trinity and Shasta reservoirs deviating from the temperature management plan modeling, or some combination of these factors.

Proposed temperature and flow operations as part of NMFS RPA Action I.2.3.C were developed to achieve maximum use of the limited cold water reserves in Shasta, Whiskeytown, and Trinity reservoirs. The highest priority for cold water management will be to improve and maintain cold water temperatures in the upper Sacramento River for protection of early life stages of Winter-run Chinook Salmon. To evaluate the potential impact of this plan, the daily temperature data from the April 90% operational forecast temperature model run were used with a dynamic simulation model using observed spawn timing, temperature, and flow data to estimate temperature-related egg and juvenile mortality during incubation and rearing. Egg mortality was estimated to be 1%, which was the same as the WY 2014's prediction in the WY 2014 TUCP (USBR 2014). Egg to fry mortality was estimated to be 22%, which was 75% of the WY 2014 prediction in the WY 2014 TUCP (USBR 2014). There is uncertainty if this is related to sources of mortality not directly estimated by the model, actual operations during late summer deviating from the temperature management plan, actual storage and temperature conditions in Trinity and Shasta reservoirs deviating from conditions assumed in the temperature management plan, or some combination of these factors.

Proposed Delta Operations- July Through November

Modification of Net Delta Outflow Index

Based on the spatio-temporal distribution of Winter-run Chinook Salmon during July, there should not be an effect of the Project Description's modification of the Net Delta Outflow Index standard.

Modification of Rio Vista Flow Requirement

Based on the spatio-temporal distribution of Winter-run Chinook Salmon during September, there should not be an effect of the Project Description's modification of the Rio Vista Flow Requirement.

Modification of Western Delta Salinity Compliance Point

Based on the spatio-temporal distribution of Winter-run Chinook Salmon between July 1 and August 15, 2015 there should not be an effect of the Project Description's modification of Western Delta Salinity Compliance Point.

Modification of the Ripon Dissolved Oxygen Requirement

Based on the spatio-temporal distribution of Winter-run Chinook Salmon between July 1 and November 15, 2015 there should not be an effect of the Project Description's modification of Ripon Dissolved Oxygen Requirement.

Extension of Water Transfer Window

Juvenile Winter-run Chinook Salmon will be present in the Sacramento River and may be present in the Delta during October and November 2015 (Table 4). Juvenile Winter-run Chinook Salmon first migrate into the Delta during the Fall when river flows or turbidity increase rapidly. These physical stimuli lead to Winter-run Chinook Salmon abandoning rearing below natal areas and increase migrating until turbidity or flows decrease. The volume and rate of releases as part of the Water Transfer are not expected to result in flow or turbidity signals that will stimulate migration.. However, the extension of the water transfer window is proposed into the Fall period when the likelihood of these physical stimuli occurring increases. The Project Description will utilize existing monitoring alerts and triggers identified in NMFS BiOp Actions IV.1.1, IV.1.2 and IV.3 (NMFS 2009) to reduce or suspend conveyance of transfer water while juvenile Winter-run Chinook Salmon are migrating to maintain protection of fish from potential effects of Interior Delta entrainment. Thus, the proposed activity is predicted not to measurably change the exposure of the population or likelihood of fish protection actions during the Project Description's period.

West False River Emergency Drought Barrier Operation

Based on the spatial distribution of adult, egg, and juvenile Winter- run Chinook Salmon, the presence of the West False River Emergency Drought Barrier operation should not have impacts on the species between July 1 and October 1, 2015. Critical habitat for Sacramento River winter-run Chinook Salmon in the Delta is limited to the Sacramento River and therefore does not include the EDB site footprint.

Biological Review of Spring-run Chinook Salmon

Updated Status of Spring-run Chinook Salmon

An updated status of Spring-run Chinook Salmon through April 21 is well-described in the Emergency Drought Barrier Aquatic Biological Assessment (DWR 2015, Environmental Baseline section). Based on daily monitoring data through May 5, 2015 the DOSS work team believes that a minority (20%) of young-of-year Brood Year 2014 Spring-run Chinook Salmon remain upstream of or in the Delta and the majority (80%) have migrated out of the Delta[3]. DOSS believes that more than 99% of BY 2013 yearling Spring-run Chinook Salmon have migrated out of the Delta. Spring-run sized juvenile Chinook have been salvaged every week since the week of March 30, 2015.

Effects of Project Description on Spring-run Chinook Salmon

Table 5: Presence of Spring run Chinook Salmon During the Project Description Period and Exposure to Potential Effects

Spring-run Chinook Salmon Life Stage	Life Stage Present	Tributary Habitat Effect	Delta Region Effect	Facility Loss Effect
Egg	This life stage will be present in the Sacramento River in September and October			
Sacramento R	Yes	Yes	N/A	N/A
Clear Creek	Yes	Yes	N/A	N/A
Juvenile	This life stage will be present in the Sacramento River and Clear Creek during late October and November			
Sacramento R	Yes	Yes	No	N/A
Clear Creek	Yes	Yes	No	N/A
Adults	This life stage will be present in the Sacramento River between July and September			
Sacramento R	Yes	No	N/A	N/A
Clear C	Yes	Yes	N/A	N/A
Stanislaus R	Yes	No	N/A	N/A

[3] [3] May 5, 2015 DOSS notes available at: http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/ocapwy2015.html

Proposed Upstream Tributary Operations- July Through November

Sacramento River

Spring-run Chinook salmon adults, eggs, and juveniles will be affected by the proposed operations on the Sacramento River (Table 5). CDFW and USFWS will conduct regular carcass surveys and aerial redd surveys during the summer 2015. Surveys will be conducted in close proximity to Spring-run spawning areas and will enable an assessment of adult prespawn, egg and alevin survival in the expected stressful water temperatures. CDFW and NMFS have monitoring and research studies planned to document and describe these effects more accurately on Winter run Chinook, which may be insightful regarding potential impacts to Spring-run Chinook Salmon in WY 2015.

Discussions on fish distribution and temperature management will occur throughout the year in the Sacramento River Temperature Task Group to iteratively inform and update temperature control operations. Temperature plan submittals to NMFS will be made according to what is laid out in RPA Action I.2.4- May 14 Through October Keswick Release Schedule (Summer Action). Based on the April 2015 Preliminary Temperature Analysis, the Project Description's model run met a temperature target of 56ºF, with a few exceedances, at the Sacramento River above Clear Creek location through October. This model run estimated the end of September lake volume below 56ºF to be approximately 340 TAF. For comparison , the 2014 April 90% operational forecast's temperature model run predicted end of September to be approximately 150 TAF, suggesting this year's plan may result in later operation of the temperature control device's side gate, which decreases the risk associated with temperature control through the TCD (USBR 2015c). As mentioned in the Method section, the temperature mortality model appears to underpredict mortality of egg and fry. There is uncertainty if this is related to sources of mortality not directly estimated by the model, actual operations during late summer deviating from the temperature management plan, actual storage and temperature conditions in Trinity and Shasta reservoirs deviating from conditions assumed in the temperature management plan, or some combination of these factors.

Proposed temperature and flow operations as part of NMFS RPA Action I.2.3.C were developed to achieve maximum use of the limited cold water reserves in Shasta, Whiskeytown, and Trinity reservoirs. Forecasted releases during July through November 2015 have been proposed that considers operating for necessary cold water temperature in the Sacramento River for Spring-run Chinook egg and fry survival. In support of these cold water needs into the Fall, the Project Description includes Reclamation bypassing power penstocks at times this year if such operation will help access remaining cold water pool or would help preserve

cold water if blending with warmer water early in the season is appropriate to meet overall CVP obligations.

Clear Creek

Spring-run Chinook salmon adults, eggs, and juveniles will be affected by the proposed operations on the Sacramento River (Table 5). USFWS will conduct Spring-run Chinook Salmon adult spawner surveys during the summer 2015. Surveys will be conducted and potentially enable an assessment of adult prespawn mortality in the expected stressful water temperatures. CDFW and NMFS have monitoring and research studies planned to document and describe these effects more accurately. A recent review of WY 2014 drought monitoring suggested monitoring of disease and pathogen during period of suboptimal water quality (Reclamation 2015c) would provide additional information to managers about temperature's effect on early life stages of Spring-run Chinook Salmon.

Based on the April 2015 Preliminary Temperature Analysis, the Project Description's model run does not meet an Igo temperature compliance location or temperature target for the duration described in NMFS RPA Action I.1.4. In this temperature model run, the 60ºF at Igo target between July 1 and September 15 is exceeded on 20% of these days in comparison to 18% of these modeled data in the WY 2014 April 90% operational forecast's temperature model run. Between September 16 and October 31, the 56ºF at Igo is exceeded 100% of these days in comparison to 76% of these modeled data in the WY 2014 April 90% operational forecast's temperature model run. These results suggest substantial egg and egg-to fry mortality for Spring-run Chinook Salmon in Clear Creek due to an inability to maintain fall coldwater temperatures in Clear Creek.

Proposed Delta Operations- July Through November

Modification of Rio Vista Flow Requirement

Based on the spatio-temporal distribution of adult Spring-run Chinook Salmon during July, there should not be an effect of the Project Description's modification of the Net Delta Outflow Index standard.

Modification of Western Delta Salinity Compliance Point

Based on the spatio-temporal distribution of Spring-run Chinook Salmon adults and eggs during September, there should not be an effect of the Project Description's modification of the Rio Vista Flow Requirement.

Modification of Western Delta Salinity Compliance Point

Based on the spatio-temporal distribution of adult Winter- run Chinook Salmon between July 1 and August 15, 2015 there should not be an effect of the Project Description's modification of Western Delta Salinity Compliance Point.

Modification of the Ripon Dissolved Oxygen Requirement

Spring-running Chinook Salmon adults have been observed at the weir on the Stanislaus River, and in deep pools upstream of Knights Ferry (RM 55) in spring and summer. The Project Description's modification of the Ripon dissolved oxygen (DO) requirement from 7.0 mg/L to 5.0 mg/L is expected to reduce the extent of the river in which dissolved oxygen is at or above 7.0 mg/L. No DO gage data is available upstream of Ripon (RM 9), so it is not known how a 5 mg/L target at Ripon translates to the downstream extent of DO of 7.0 mg/L or greater. Temperatures are expected to be unsuitable for any holding adult spring-running Chinook Salmon downstream of Orange Blossom (RM 46) during the summer of WY 2015, so a contraction of suitable DO conditions upstream of Ripon (RM 9) may not impact spring-running Chinook adults in holding habitats further upstream where temperatures are cooler and dissolved oxygen levels are expected to remain at suitable levels.

Extension of Water Transfer Window

Juvenile Spring-run Chinook Salmon may be present in the Sacramento River during late October and November 2015. Young of the Year Brood Year 2015 and yearling Brood Year 2014 Spring-run Chinook will migrate into the Delta during Fall 2015 when river flows or turbidity increase rapidly and/or temperatures decrease. These physical stimuli lead to Spring-run Chinook Salmon abandoning rearing in natal areas and increasing migratory behavior until turbidity or flows decrease. The volume and rate of releases as part of the water transfer proposed action will not change the likelihood of these physical stimuli being exceeded. The extension of the water transfer window is proposed into the Fall period when the likelihood of these physical stimuli occurring increases. Thus, the Project Description will utilize existing monitoring alerts and triggers for Spring-run Chinook Salmon identified in NMFS BiOp Action IV.1.1, IV.1.2 and IV.3 (NMFS 2009). Use of these monitoring alerts and triggers to reduce or suspend conveyance of transfer water while juvenile Spring-run Chinook Salmon are migrating will maintain protection of fish from potential effects of Interior Delta entrainment. Thus, the proposed activity is predicted not to change the exposure of the population or likelihood of fish protection actions during the Project Description's period.

West False River Emergency Drought Barrier Operation

Based on the spatio-temporal distribution of adult, egg, and juvenile Spring-run Chinook Salmon, the presence of the West False River Emergency Drought Barrier should not have impacts on the species between approximately July 1 and October 1 2015. Impacts to critical habitat after May 1 as part of construction and as late as November 15 as part of deconstruction of the EDB are described in DWR (2015), and are being concurrently evaluated through a separate consultation process. Critical habitat for Spring-run Chinook Salmon in the Delta includes estuarine areas free of migratory obstructions, and the EDB is an

obstruction. These areas support juvenile and adult physiological transitions with suitable water quality, quantity and salinity. The EDB will modify salinity conditions while it is present, but salinity conditions will return to baseline conditions prior to a spatio-temporal overlap of adult and juvenile spring-run Chinook Salmon with the Barrier's action area of the Delta. Thus, operation of the EDB will not measurably effect juvenile or adult Spring-run Chinook Salmon physiological transitions.

Biological Review of Green Sturgeon

Updated Status of Green Sturgeon

An updated status of green sturgeon through April 21 is well-described in the Emergency Drought Barrier Aquatic Biological Assessment (DWR 2015, Environmental Baseline section).

Effects of Project Description on Green Sturgeon

Table 6: Presence of Green Sturgeon During the Project Description Period and Exposure to Potential Effects

Green Sturgeon Life Stage	Life Stage Present	Tributary Habitat Effect	Delta Region Effect	Facility Loss Effect
Egg	This life stage will be present in the Sacramento River in early July.			
Sacramento R	Yes	Yes	N/A	N/A
Juvenile	This life stage will be present in the Sacramento River and Delta in July through November.			
Sacramento R	Yes	Yes	N/A	N/A
Delta	Yes	N/A	No	No
Subadults	This life stage will be present in the Bay, not in the Delta.			
Delta	No	N/A	No	No
Adults	This life stage will be present in the Sacramento River and Delta July through November.			
River	Yes	No	N/A	N/A
Delta	Yes	N/A	No	No

Proposed Upstream Tributary Operations- July Through November

Sacramento River

Green sturgeon eggs, juveniles, and adults will be in Sacramento River during the project description's period (Table 6). Proposed temperature and flow operations as part of NMFS RPA Action I.2.3.C were developed to achieve maximum use of the limited cold water reserves in Shasta, Whiskeytown, and Trinity reservoirs during the remainder of WY 2015 and early WY 2016. Forecasted releases during July through November 2015 have been proposed to prioritize use of the cold water reserve for protection of early life stages of Winter run Chinook Salmon. These cold water temperatures are likely supportive of a greater length of river for

green sturgeon spawning, egg incubation, and juvenile rearing between July 1 and November 30.

Proposed Delta Operations- July Through November

Modification of Rio Vista Flow Requirement

Based on the spatio-temporal distribution of green sturgeon during July, there should not be an effect of the Project Description's modification of the Net Delta Outflow Index standard.

Modification of Western Delta Salinity Compliance Point

Based on the spatio-temporal distribution of green sturgeon during September, there should not be an effect of the Project Description's modification of the Rio Vista Flow Requirement.

Modification of Western Delta Salinity Compliance Point

Based on the spatio-temporal distribution of green sturgeon between July 1 and August 15, 2015 there should not be an effect of the Project Description's modification of Western Delta Salinity Compliance Point.

Modification of the Ripon Dissolved Oxygen Requirement

Because green sturgeon are not expected to be present in the Stanislaus River, there should not be an effect of the Project Description's modification of the Ripon Dissolved Oxygen Requirement.

West False River Emergency Drought Barrier Operation

Based on the spatio-temporal distribution of juvenile and adult green sturgeon, these lifestages may be in the Emergency Drought Barrier action area (DWR 2015) during its presence between approximately July 1 and October 1 2015. Impacts to critical habitat after May 1 as part of construction and as late as November 15 as part of deconstruction of the EDB are described in DWR (2015), and are being concurrently evaluated through a separate consultation process. Juvenile green sturgeon live in the freshwater Bay-Delta during the summer and fall, and adult green sturgeon may outmigrate during the summer back to San Francisco Bay. Critical habitat for the Southern DPS of North American green sturgeon includes the estuarine waters of the Delta, which contain the following PCEs: food resources, water flow, water quality, migratory corridors, water depth, and sediment quality.

The EDB will reduce the connectivity of green sturgeon freshwater habitats, but should not limit the foraging or rearing of juvenile or adult green sturgeon in the Delta. Little is known about the rearing habitats of green sturgeon in the Delta, but historic data found these juvenile green sturgeon along the San Joaquin River (Ratdke 1966). The extent to which habitat in the Barrier action area is a migratory corridor is unknown, but the main migratory corridor for adult green sturgeon appears to be between the Sacramento River spawning area and western Delta adult rearing/foraging habitats (Israel et al. 2010). If green sturgeon utilize

West False River for migration during the summer, it may cause delay in passage into or out of the South Delta.

Biological Review of Central Valley Steelhead

Updated Status of Central Valley Steelhead

An updated status of steelhead through April 21 is well-described in the Emergency Drought Barrier Aquatic Biological Assessment (DWR 2015, Environmental Baseline section). Based on daily monitoring data through May 5, 2015 the DOSS workteam believes that a minority (10-15%) of San Joaquin River juvenile steelhead remain the Delta and the majority (80-85%) have migrated out of the Delta[4]. Due to limited catch data, DOSS did not estimate the current distribution of Sacramento River steelhead. Wild juvenile Central Valley Steelhead were salvaged in November, February, and mid to late April.

Effects of Project Description on Central Valley Steelhead

Table 7: Presence of Central Valley Steelhead During the Project Description Period and Exposure to Potential Effects

Steelhead Life Stage	Life Stage Present	Tributary Habitat Effect	Delta Region Effect	Facility Loss Effect
Egg	This life stage is not present in the Sacramento River and San Joaquin River during July through November.			
Sacramento R and tributaries	No	N/A	N/A	N/A
San Joaquin R and Stanislaus R	No	N/A	N/A	N/A
Juvenile	This life stage will be present in the Sacramento River and San Joaquin River during July through November. Juveniles may be exiting the Delta in July and November			
Sacramento R and tributaries	Yes	No Change	N/A	N/A
San Joaquin R and Stanislaus R	Yes	No	N/A	N/A
Delta	Yes	N/A	No	No
Adults	This life stage will be present in the Sacramento and San Joaquin Rivers and			

[4] [4] May 5, 2015 DOSS notes available at: http://www.westcoast.fisheries.noaa.gov/central_valley/water_operations/ocapwy2015.html

	Delta during July through November			
Sacramento R and tributaries	Yes	No	N/A	N/A
San Joaquin R and Stanislaus R	Yes	No	N/A	N/A

Proposed Upstream Tributary Operations- July Through November

American River

Juvenile and adult steelhead may be in the American River between July and November (Table 7). Based on the April 2015 Preliminary Temperature Analysis on the American River, the Project Description's iCPMM model run could maintain temperatures targeting 72ºF upstream of Watt Avenue. This temperature is likely to make meeting 68ºF at Watt Avenue unattainable for a portion of the period between May 15 and October 1 per NMFS RPA Action II.2. Juvenile steelhead are present in the American River year round. Over-summer rearing habitat for these fish may be reduced due to temperatures greater than 68ºF in a portion of the rearing habitat. Adult steelhead enter the river in November. Key biological responses during the adult life stage such as survival and egg maturation are not predicted to be affected by the Project Description's temperature operation.

Proposed Delta Operations- July Through November

Modification of Rio Vista Flow Requirement

Based on the spatio-temporal distribution of steelhead during July, there should not be an effect of the Project Description's modification of the Net Delta Outflow Index standard.

Modification of Western Delta Salinity Compliance Point

Based on the spatio-temporal distribution of steelhead during September, there should not be an effect of the Project Description's modification of the Rio Vista Flow Requirement.

Modification of Western Delta Salinity Compliance Point

Based on the spatio-temporal distribution of steelhead between July 1 and August 15, 2015 there should not be an effect of the Project Description's modification of Western Delta Salinity Compliance Point.

Modification of the Ripon Dissolved Oxygen Requirement

During the summer, *O. mykiss* juvenile and adults are likely to be present primarily above Orange Blossom (RM 46). Based on Caswell Trap (RM 9) monitoring. *O. mykiss* have been observed in the lower Stanislaus River as late as the end of June (USBR 2015d). The Project Description's modification of the Ripon dissolved oxygen requirement from 7.0 mg/L to 5.0 mg/L is expected to reduce the extent of the river in which dissolved oxygen is at or above 7.0 mg/L.

Oxygen distress can occur in salmonids at DO concentrations less than 6.5 mg/L causing reduced swimming ability and growth (Carter 2005). No DO gage data is available upstream of Ripon, so it is not known how a 5 mg/L target at Ripon translates to the downstream extent of DO of 7.0 mg/L or higher. Temperatures at Ripon (RM 9) are expected to be unsuitable for rearing steelhead juveniles and adult steelhead during the summer of WY 2015, so contraction of suitable DO conditions may not impact juvenile or adult steelhead if they are holding farther upstream where temperatures are cooler and dissolved oxygen is expected to be higher.

West False River Emergency Drought Barrier Operation

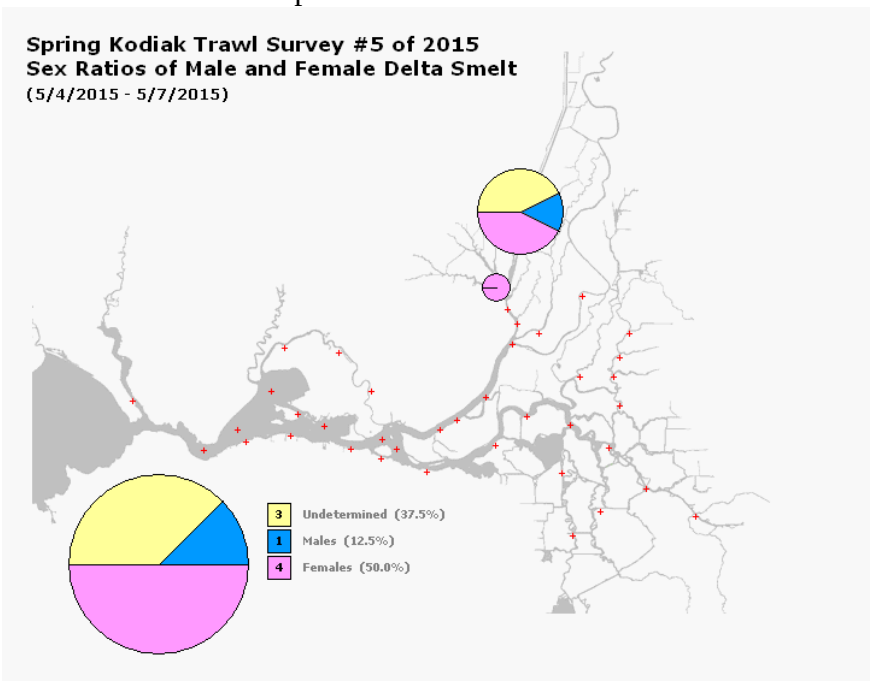
Based on the historical spatio-temporal distribution of adult Central Valley steelhead, adult lifestage may be in the EDB action area during its presence between approximately July 1 and October 1 2015. Impacts to critical habitat after May 1 as part of construction and as late as November 15 as part of deconstruction of the EDB are described in DWR (2015), and are being concurrently evaluated through a separate consultation process. Historically, adult steelhead migrated up the Sacramento River from July through October, and thus a significant proportion of upstream migrants could enter the Delta during the presence of the EDB. Historical information on upstream migration timing of San Joaquin River steelhead is lacking. Furthermore, contemporary timing and movement information for Sacramento and San Joaquin river adult steelhead upstream migrants is lacking.

Critical habitat for Central Valley steelhead in the Delta includes estuarine areas free of migratory obstructions. The EDB will reduce the connectivity of Central Valley steelhead migratory corridor habitat, however the EDB will be removed by mid-November before the majority (more than 90%) of juvenile Sacramento origin steelhead are expected to pass Knights Landing and migrate into the Delta (NMFS 2009). Less information is known about San Joaquin River steelhead, but juveniles appear to migrate between December and June, which is outside the time when the EDB will be present.

Effects of Project Description on Delta Smelt

Current Delta Smelt Distribution

SKT #5 was in the field the week of May 4, 2015 and yielded presence of 4 adults in the Deep water shipping channel, three of which were females, and 3 juveniles (Figure 3A). One more pre-spawned female was caught in Cache Slough. One of the three females was reported to have reabsorbed her eggs, which is an indicator of spawning failure[3]. SKT #4 was in the field the week of April 6, 2015. A single ripe adult male was caught at station 719 (Figure 3B). A preliminary review (SWG notes 4/13/2015) of historical SKT data indicated that this is a record low catch for SKT #4. In the final week (March 30, 2015) of supplemental U.S. Fish and Wildlife Service sampling in the lower San Joaquin River (Jersey Point, Figure 4), which consisted of 15 trawls per day and concluded on March 31, 2015, catch of adult Delta Smelt declined precipitously to zero in the final month of sampling. This evidence suggests the majority of the adult population is outside the influence of the export facilities.



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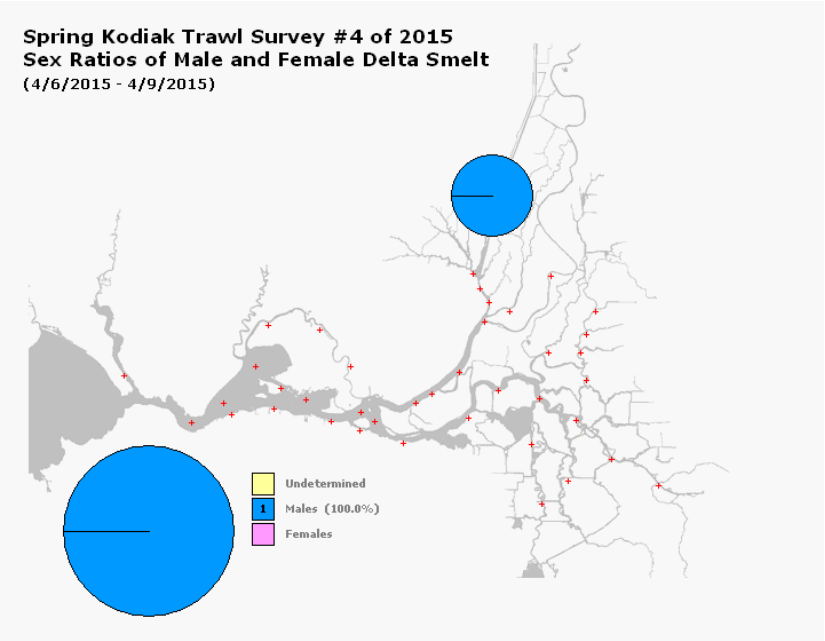


Figure 3. 2015 Spring Kodiak Trawl #5 (A) and #4 (B) Delta Smelt Catch[5]. Red crosses indicate surveyed stations with zero catch.

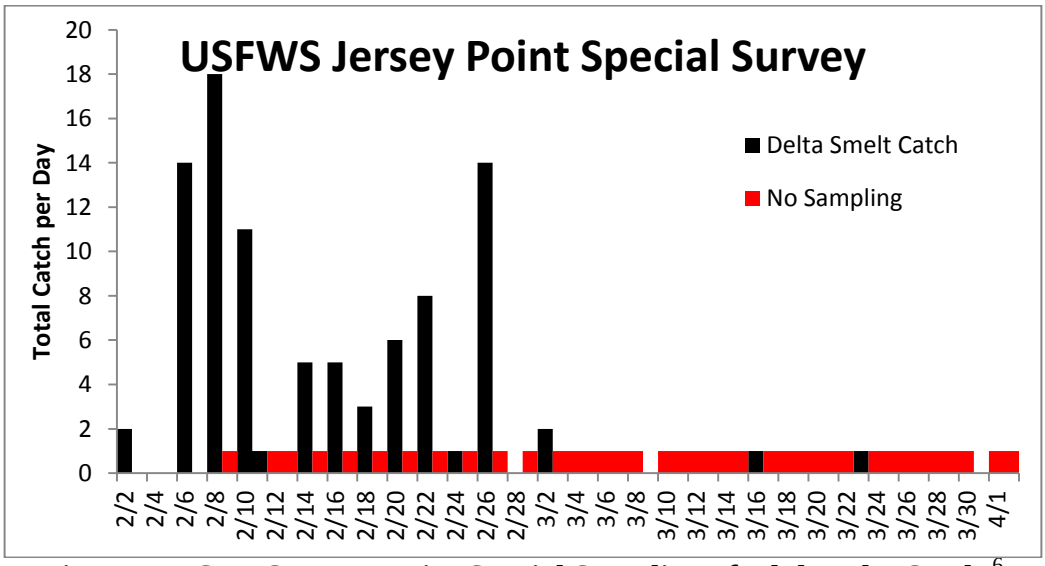


Figure 4. USFWS Jersey Point Special Sampling of adult Delta Smelt.[6]

No adult Delta Smelt have been observed in salvage since February 21, 2015, at the South Delta fish facilities, and low (n=1 at the SWP, n=3 at the CVP) levels of salvage of young-of-year Delta Smelt were reported on May 4, the first of the season. However, pre-screen loss and entrainment effects (e.g., predation) can occur despite lack of observed salvage at the facilities, and these effects are

[5] Retrieved from <http://www.dfg.ca.gov/delta/projects.asp?ProjectID=SKT> on 4/22/15.
[6] Data provided to Smelt Working Group.

difficult to detect and quantify. In addition, salvage operations at the CVP were sporadically impacted by high levels of debris and outages.

Delta Smelt spawning is likely to have peaked in March or April, with larvae detected in the Sacramento River system as of March 2-4 (Figure 5), and larvae detected in the lower San Joaquin River as of March 24-26 during the Smelt Larval Survey (Figure 6). A 20 mm survey, conducted March 30 – April 8, 2015, detected juvenile Delta Smelt in the San Joaquin River at Jersey Point (Figure 7), but subsequent two surveys reflected presence only in the deep water shipping channel in the vicinity of station 719 (Figure 8). Larvae and juveniles in the lower San Joaquin River are potentially susceptible to the effects of South Delta exports. Hatching may continue over the next couple of weeks, although the peak of the spawning season has likely passed. As water temperatures rise, larvae will start to recruit to juvenile size and may begin to disperse further throughout the system. The majority of members of the Smelt Working Group expect that larval and juvenile Delta Smelt may not be detected in salvage because numbers are so low as to be at detection levels of the larval surveys (Smelt Working Group-notes from 4/13/2015)[7]. A temperature off-ramp occurs when water temperatures at Clifton Court reach 25°C for three consecutive days (FWS BO 2008). This off-ramp typically occurs in late June, but given unseasonably warm April temperatures due to the ongoing drought, it is likely that this threshold will be met earlier in 2015 (an alternate, calendar based off ramp is June 30).

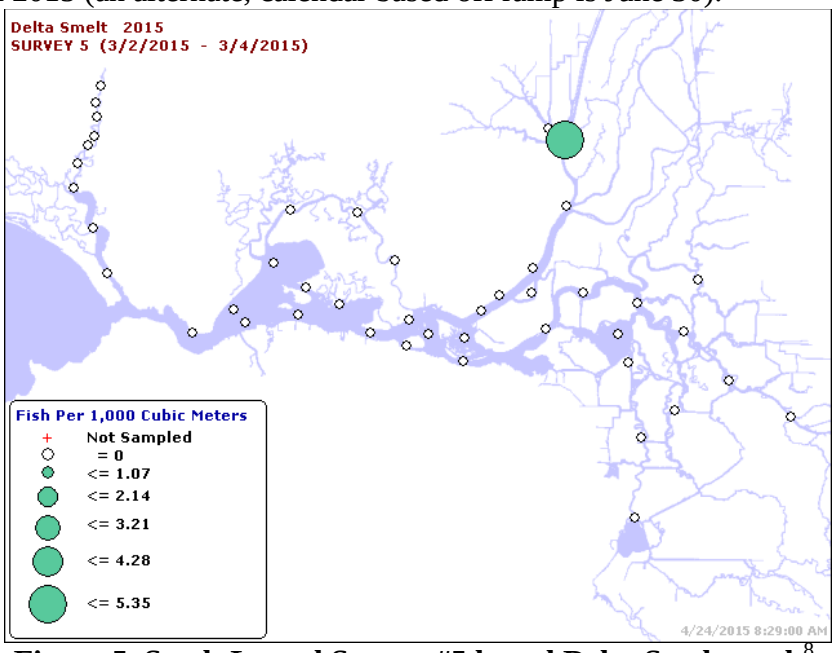


Figure 5. Smelt Larval Survey #5 larval Delta Smelt catch[8].

[7] Smelt Working Group notes, available on the internet at <http://www.fws.gov/sfbaydelta/documents/smelt_working_group/swg_notes_4_13_2015.pdf>

[8] Retrieved from <http://www.dfg.ca.gov/delta/projects.asp?ProjectID=SLS> on 4/22/15.

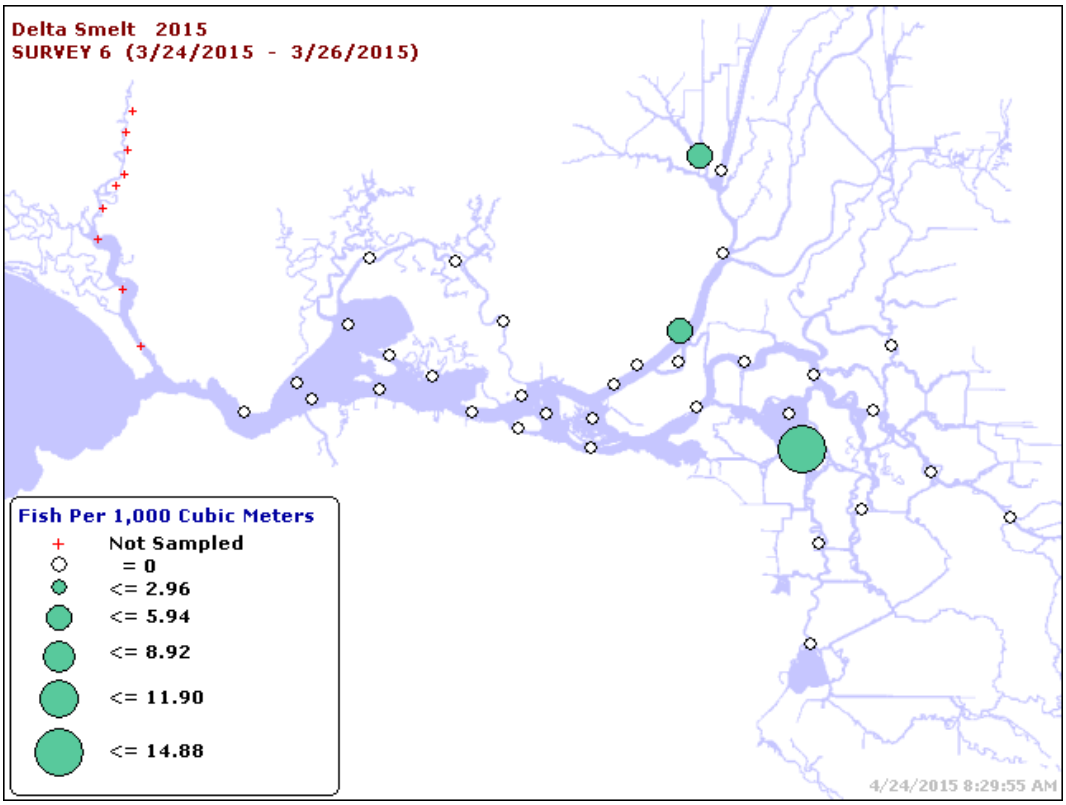


Figure 6. Smelt Larval Survey #6 larval Delta Smelt catch .

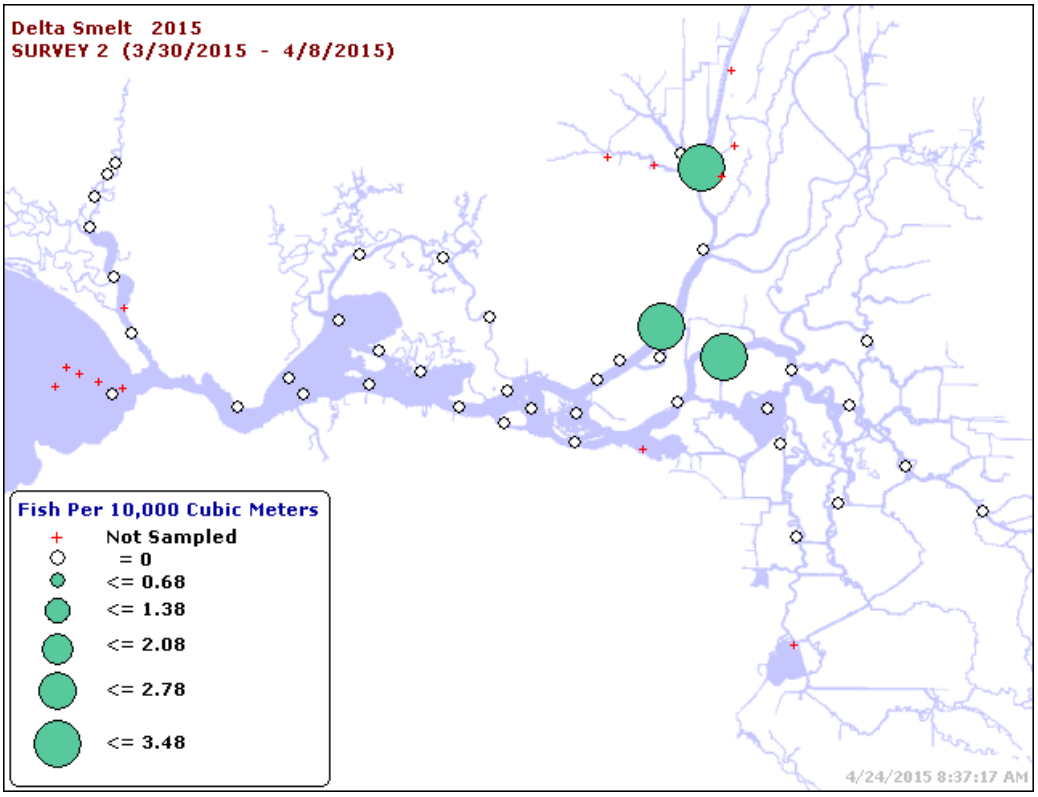


Figure 7. 20mm survey #2 catch of juvenile Delta Smelt.

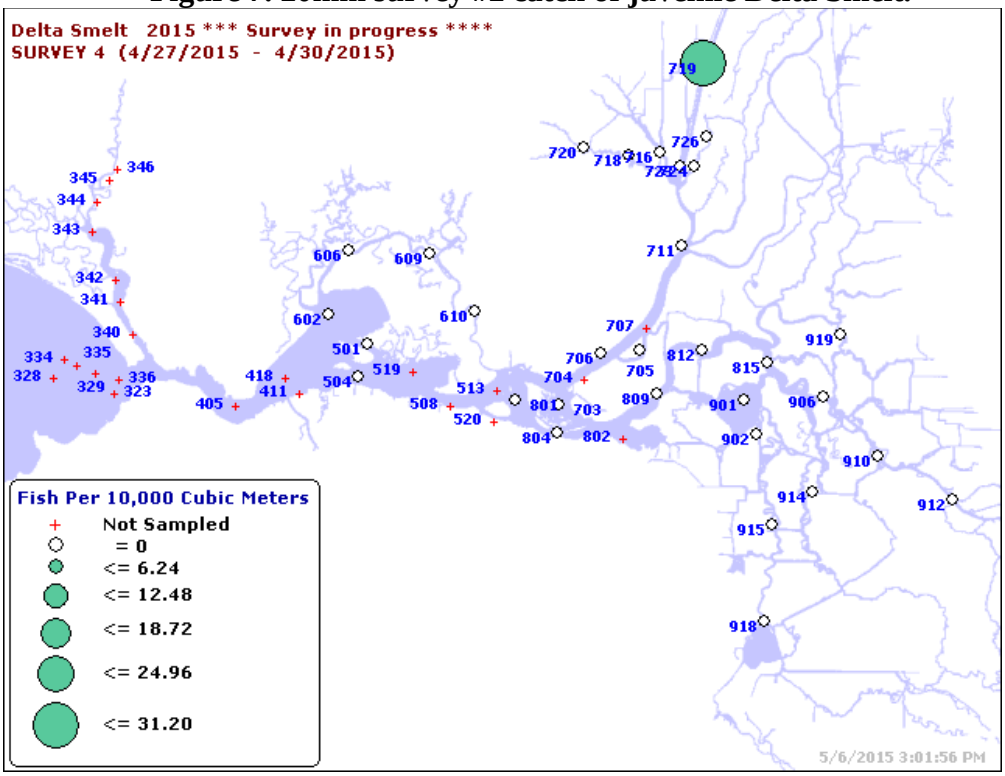


Figure 8. 20mm survey #4 catch of juvenile Delta Smelt reflected a nearly identical distribution as 20mm survey #3 (not shown).

Effects of Proposed Action Specific to Delta Smelt Designated Critical Habitat

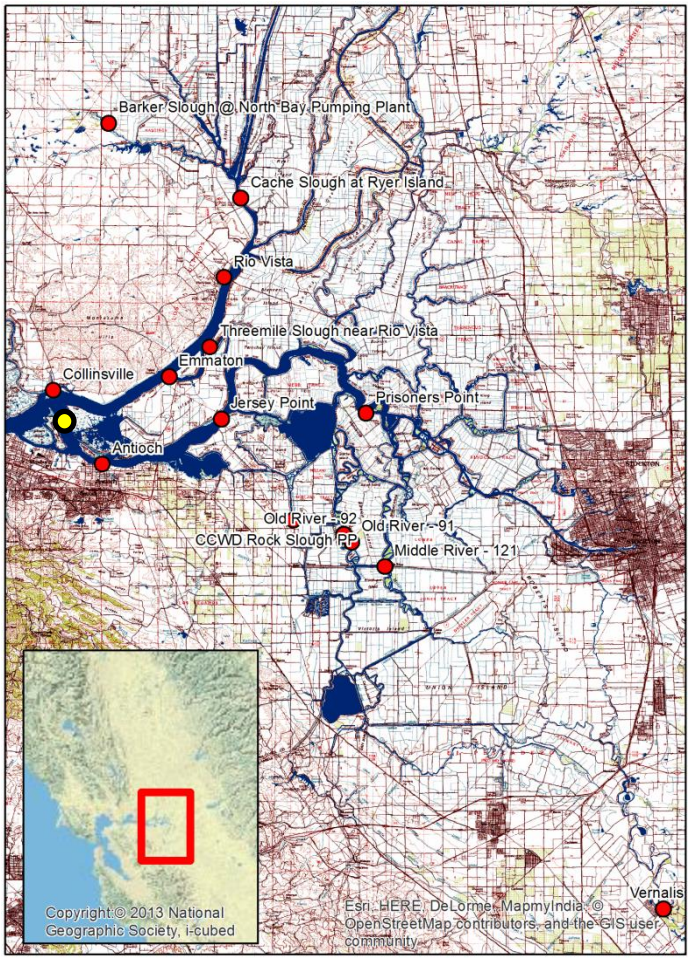


Figure 9. Modeled locations in the Delta (red) and the West False River Barrier (yellow).

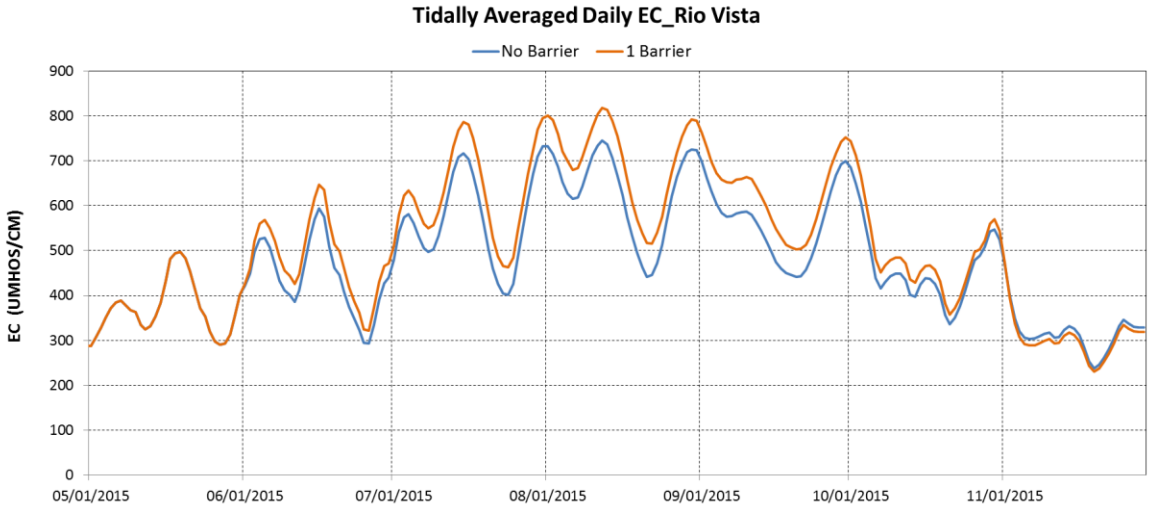


Figure 10. Forecasted tidally averaged Electrical Conductivity at Rio Vista, based on April 90% forecast from DSM2 models with and without the West False River Emergency Drought Barrier.

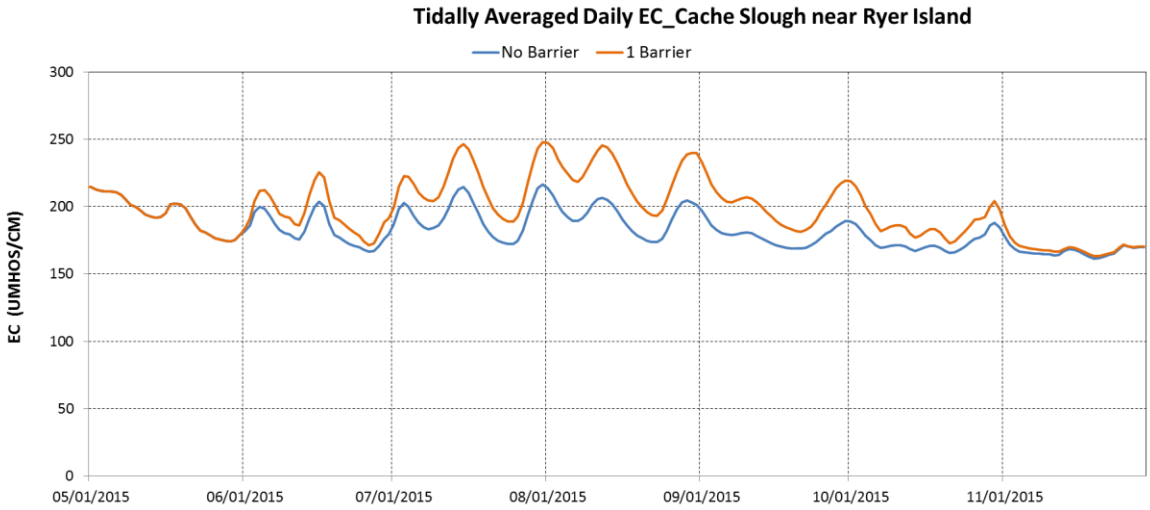


Figure 11. Forecasted tidally averaged Electrical Conductivity in Cache Slough near Ryer Island, based on April 90% forecast from DSM2 models with and without the West False River Emergency Drought Barrier.

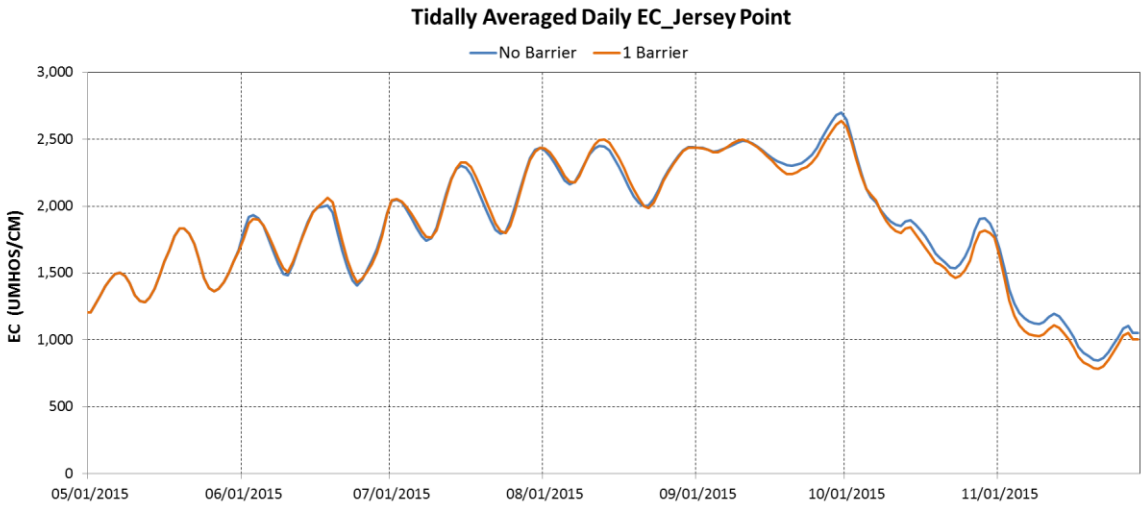


Figure 12. Forecasted tidally averaged Electrical Conductivity at Jersey Point, based on April 90% forecast from DSM2 models with and without the West False River Emergency Drought Barrier.

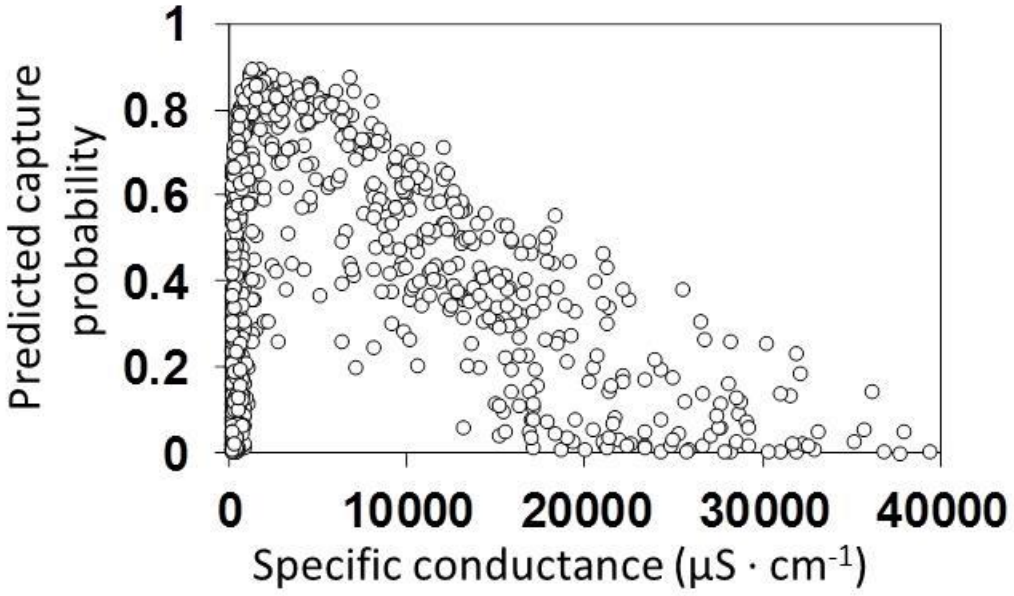


Figure 13. Predicted capture probability of Delta Smelt juveniles in 1974-2004 July Summer Townet Surveys from generalized additive modeling in relation to specific conductance (microSiemens cm^{-1} [= micromhos cm^{-1}]) with scatter depicting variation caused by secchi depth and water temperature.[9]

[9] Source: Nobriga et al. 2008.

DSM2 models indicate that installation of a barrier across West False River will result in elevated salinities up to approximately 100 micromhos per centimeter (µmhos cm^{-1}) in the Sacramento River at Rio Vista (Figure 10) and to a lesser degree (~50 µmhos cm^{-1}) in the Cache Slough Complex (Figure 11). This effect was not evident in the lower San Joaquin River at Jersey Point (Figure 12) and appears to mainly be a result of increased tidal excursion. These differences are marginal in the context of the range of salinity in which Delta Smelt have been caught in the past (Nobriga et al, 2008; Figure 13). Similarly, the effects of a barrier on flows in the lower Sacramento River at Jersey Point (Figure 14) and Rio Vista (Figure 15) are minor relative to the tidal influence in those areas.

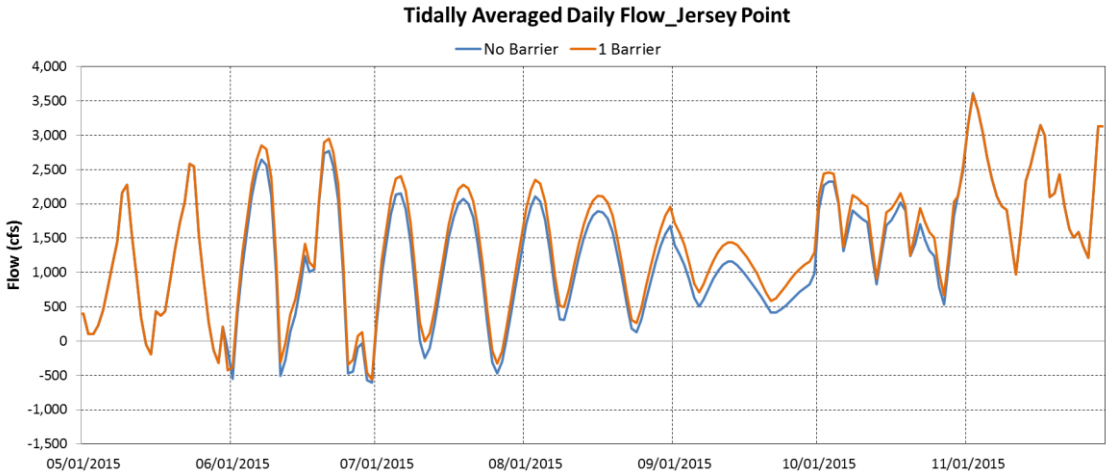


Figure 14. Forecasted tidally averaged flow at Jersey Point, based on April 90% forecast from DSM2 models with and without the West False River Emergency Drought Barrier.

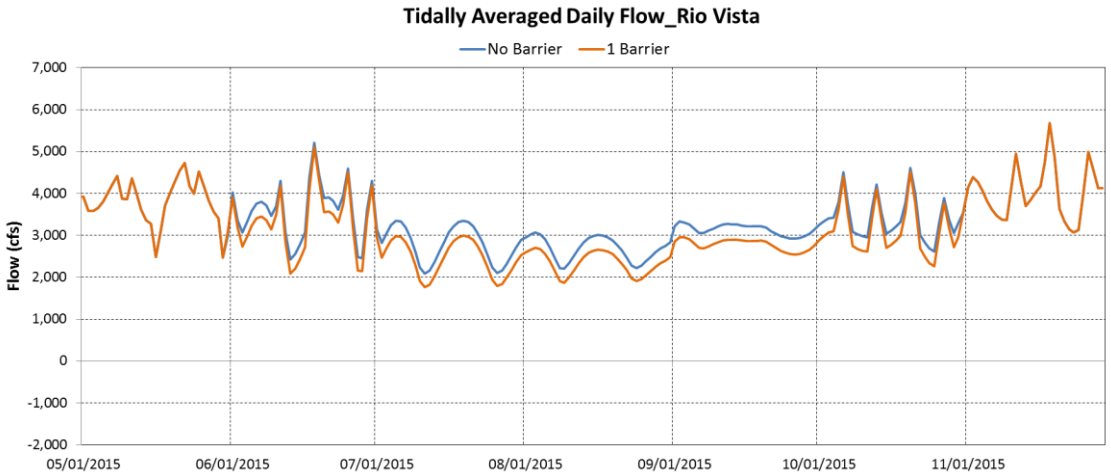


Figure 15. Forecasted tidally averaged flow at Rio Vista, based on April 90% forecast from DSM2 models with and without the West False River Emergency Drought Barrier.

Physical habitat and water quality would be affected by the proposed modifications. The upstream relocation of the Western Delta Salinity Standard from Emmaton to Three Mile Slough and reduction in outflows will result in salinity moving further upstream on the lower Sacramento and San Joaquin Rivers (Figures 16-21). Due to the potential for Sacramento River origin water to be transported through the Delta Cross Channel to the San Joaquin River, the upstream tidal excursion of higher salinity water is expected to be more pronounced on the Sacramento River than the San Joaquin River. For example, DSM2 modeling estimated that change in conductivity at Emmaton would be elevated by approximately 1000 micromhos per centimeter (µmhos cm^{-1}) from July-November (Figure 21) whereas the difference at Prisoners Point in the lower San Joaquin is 100 µmhos cm^{-1} over the same time period.

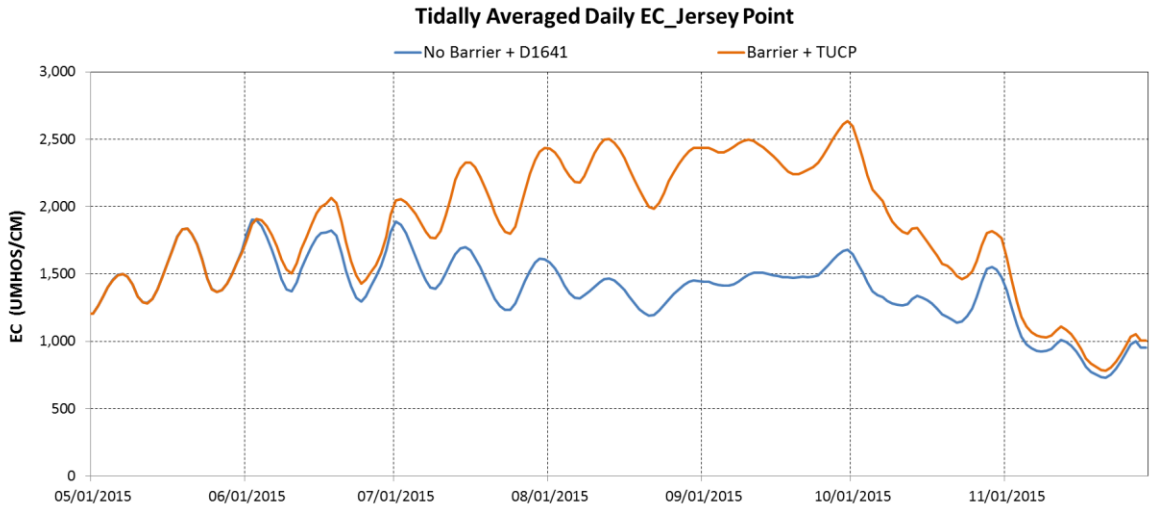


Figure 16. Forecasted tidally averaged Electrical Conductivity at Jersey Point, based on April 90% forecast from DSM2 models under TUCP conditions with the West False River Emergency Drought Barrier and without the barrier under D1641 compliance.

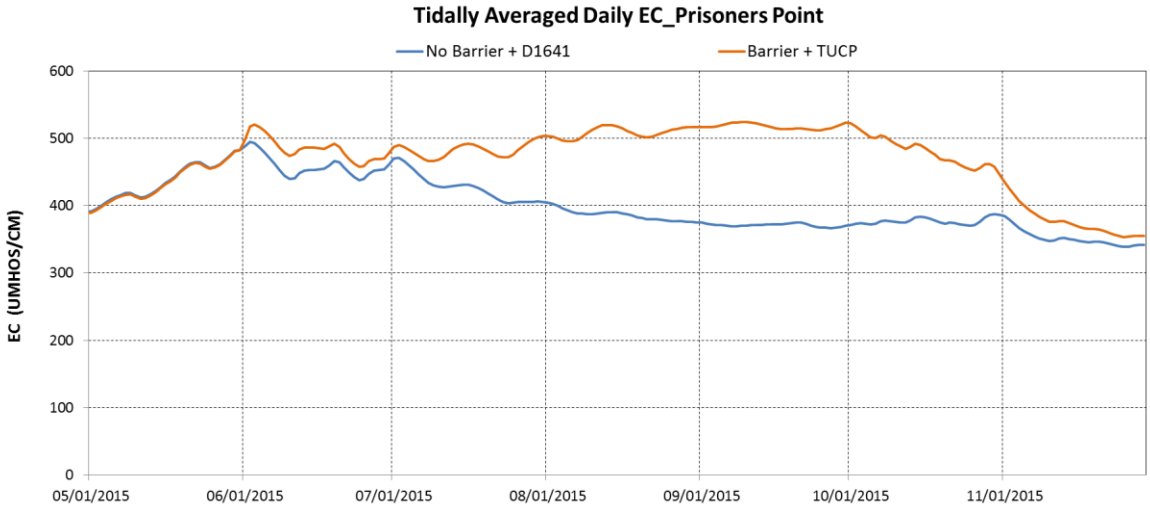


Figure 17. Forecasted tidally averaged Electrical Conductivity at Prisoners Point, based on April 90% forecast from DSM2 models under TUCP conditions with the West False River Emergency Drought Barrier and without the barrier under D1641 compliance.

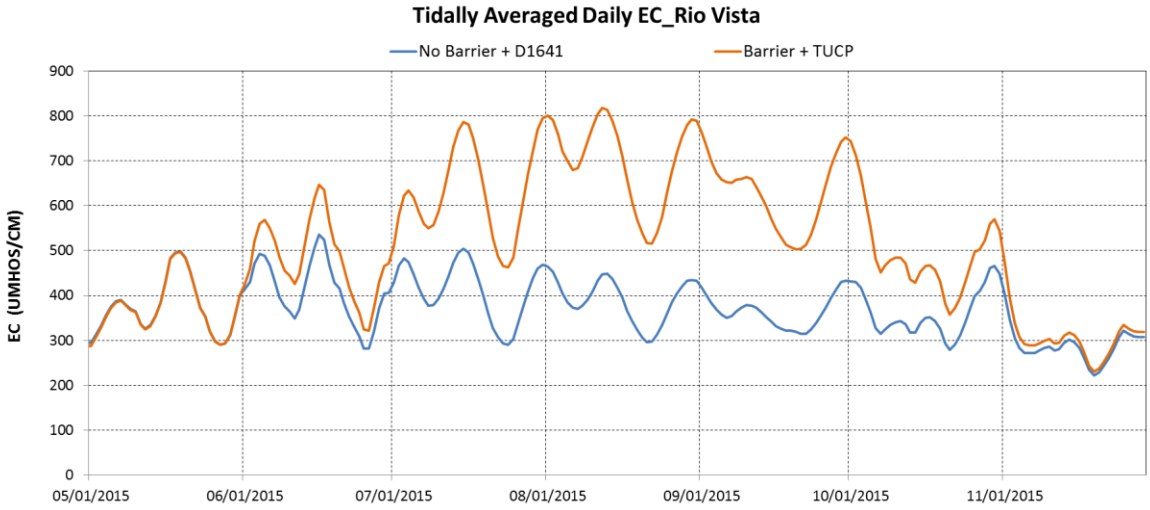


Figure 18. Forecasted tidally averaged Electrical Conductivity at Rio Vista, based on April 90% forecast from DSM2 models under TUCP conditions with the West False River Emergency Drought Barrier and without the barrier under D1641 compliance.

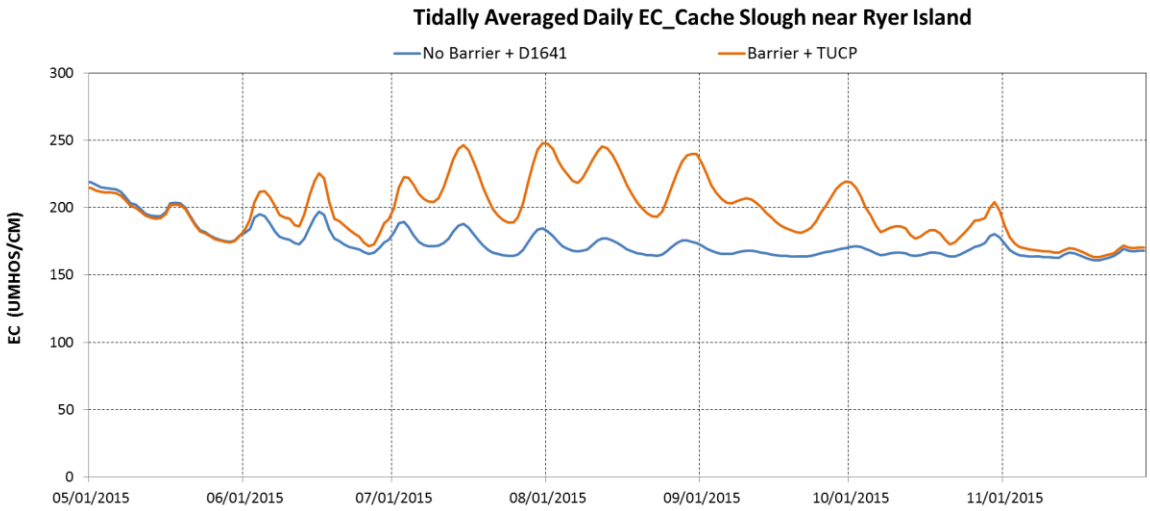


Figure 19. Forecasted tidally averaged Electrical Conductivity at Cache Slough, based on April 90% forecast from DSM2 models under TUCP conditions with the West False River Emergency Drought Barrier and without the barrier under D1641 compliance.

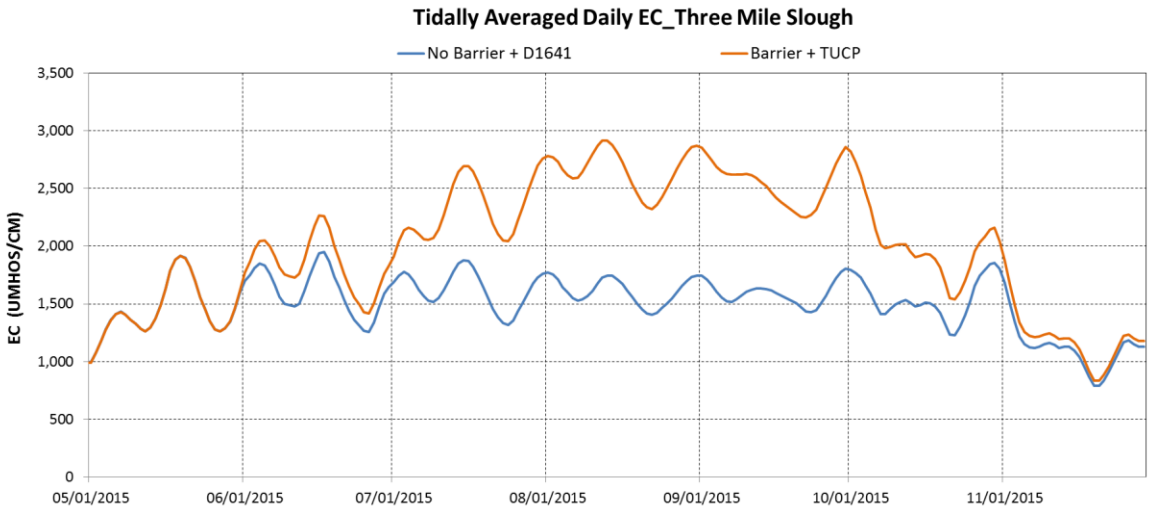


Figure 20. Forecasted tidally averaged Electrical Conductivity at Three Mile Slough, based on April 90% forecast from DSM2 models under TUCP conditions with the West False River Emergency Drought Barrier and without the barrier under D1641 compliance.

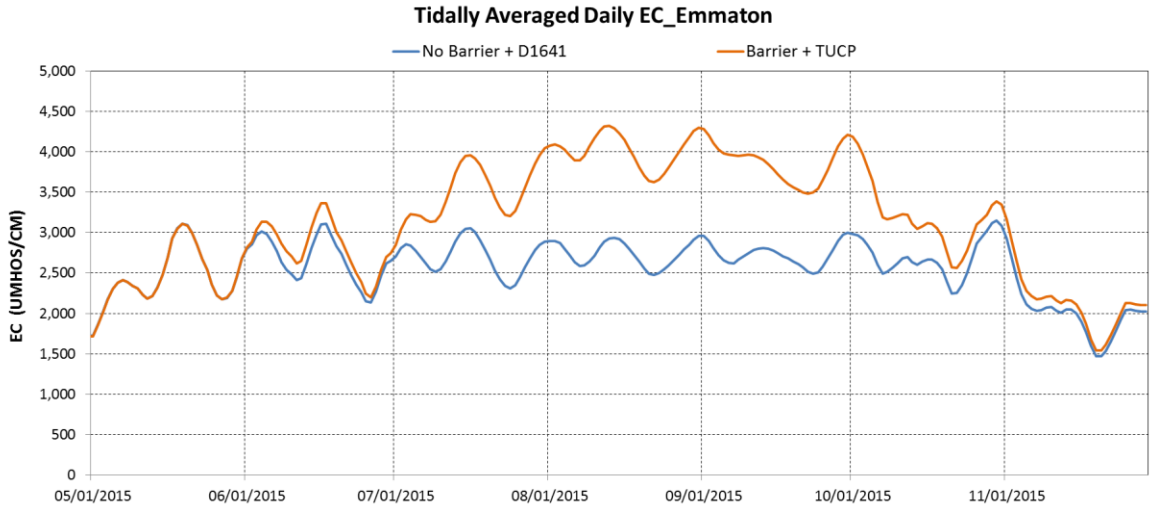


Figure 21. Forecasted tidally averaged Electrical Conductivity at Emmaton, based on April 90% forecast from DSM2 models under TUCP conditions with the West False River Emergency Drought Barrier and without the barrier under D1641 compliance.

This would cause an upstream relocation of X2, which is a specific point within the low salinity zone (LSZ) where the average daily salinity at the bottom of the water column is 2 psu (Jassby et al. 1995). By local convention X2 is described in terms of distance from the 2 psu isohaline to the Golden Gate Bridge. Ecologically, X2 serves as an indicator of habitat suitability for many San Francisco Estuary organisms and is associated with variance in abundance of diverse components of the ecosystem (Jassby et al. 1995). The LSZ expands and moves downstream when river flows into the estuary are high. Similarly, it contracts and moves upstream when river flows are low. During the past 40 years, monthly average X2 has varied from as far downstream as San Pablo Bay (45 km) to as far upstream as Rio Vista on the Sacramento River (95 km). At all times of year, the location of X2 influences both the area and quality of habitat available for Delta Smelt to successfully complete their life cycle. In general, Delta Smelt habitat quality and surface area are greater when X2 is located in Suisun Bay. Both habitat quality and quantity diminish the more frequently and further the LSZ moves upstream, toward the confluence of the Sacramento and San Joaquin rivers (Feyrer et al. 2007), thus further constraining the habitat for juvenile Delta Smelt closer to the upstream spawning areas in the lower Sacramento River, San Joaquin River, and the Cache Slough Complex/Sacramento Deep Water Ship Channel. DSM2 forecasts X2 towards the upstream end of the range in the Sacramento River between June and November, with greater differences between the D1641 baseline and the proposed action occurring between July and September (Figure 22).

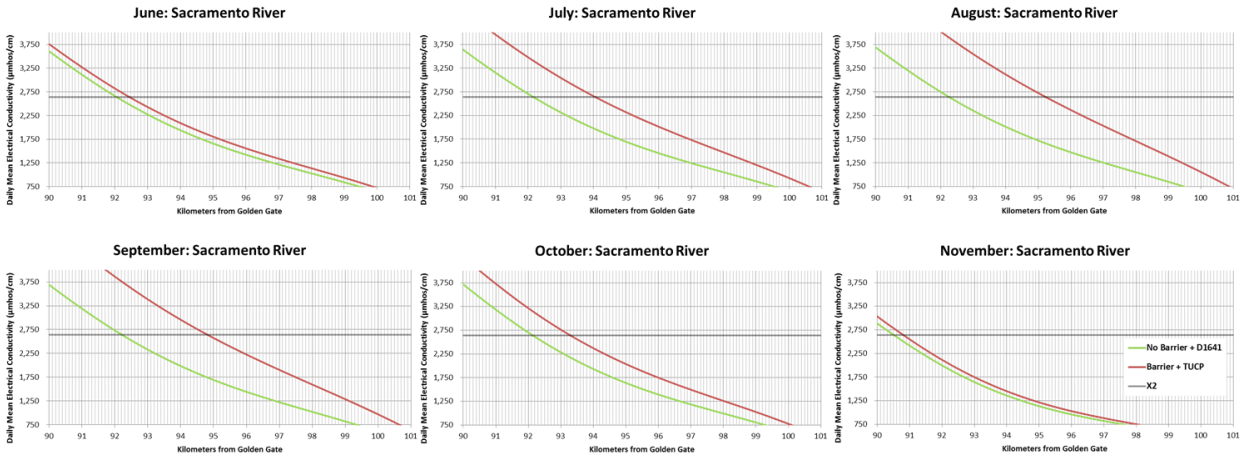


Figure 12. Forecasted position of X2 (dark grey line = 2 psu isohaline), based on April 90% forecast from DSM2 models of electrical conductivity under TUCP conditions with the West False River Emergency Drought Barrier (red line) and without the barrier under D1641 compliance (green line).

Although these changes will reduce the quantity of available habitat, conductivity within this habitat will be within the range of salinity generally occupied by Delta Smelt during the summer and fall. Also as Sommer and Mejia (2013) noted, Delta Smelt are not confined to a narrow salinity range and occur from fresh water to relatively high salinity, even though the center of distribution is consistently associated with X2 (Sommer et al. 2011). Conductivity forecasts for Three Mile Slough (Figure 20) and locations upstream are within the range in which they have been encountered during the period modeled. Therefore we conclude that while changes in salinity in the lower Sacramento River are within the physiological tolerances of Delta Smelt, the proposed modifications may shift the Delta Smelt population upstream.

An upstream shift of Delta Smelt distribution on the Sacramento River will increase the potential for stochastic events to exacerbate mortality on the population (Feyrer et al. 2011). For example, water temperature increases during prolonged heat waves could pose risks to persistence of local populations. In general, summer temperatures are higher in landward channels (Wagner 2012), so reduced outflow associated with the proposed action (Figures 23-24) is expected to shift the distribution of Delta Smelt into these warmer regions.

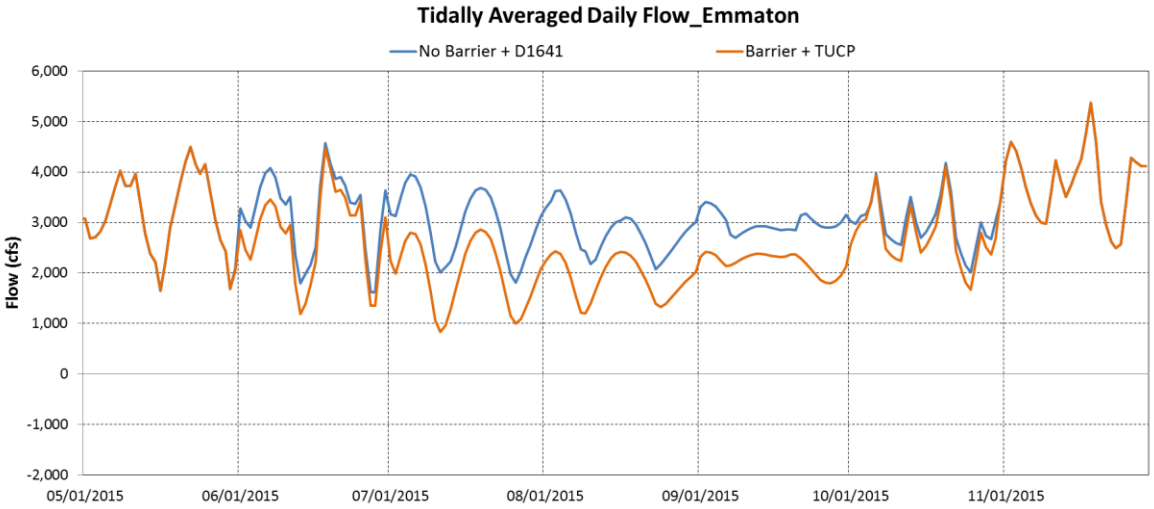


Figure 23. Forecasted flow at Emmaton, based on April 90% forecast from DSM2 models under TUCP conditions with the West False River Emergency Drought Barrier (red line) and without the barrier under D1641 compliance (blue line).

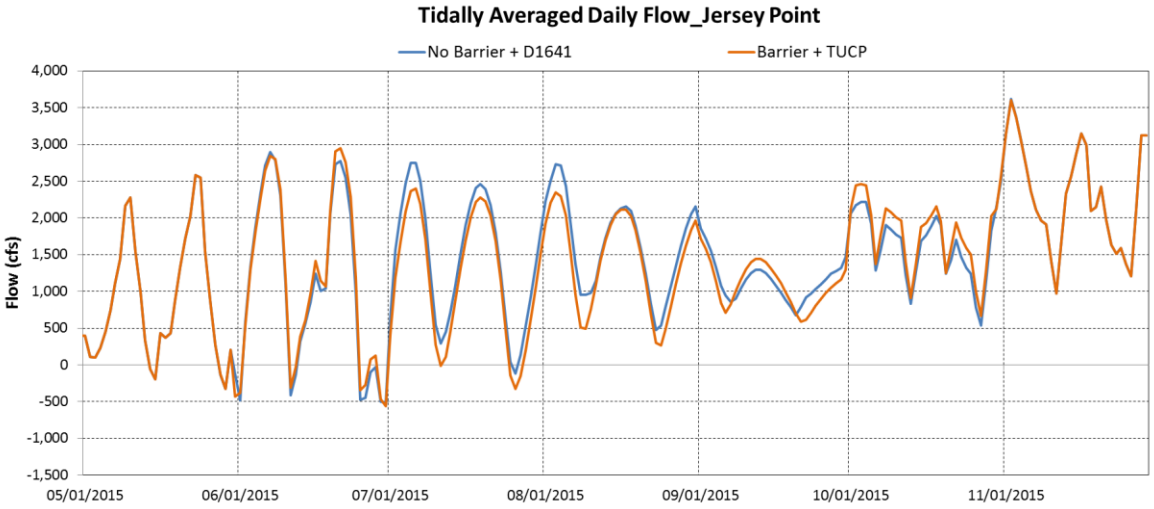


Figure 24. Forecasted flow at Jersey Point, based on April 90% forecast from DSM2 models under TUCP conditions with the West False River Emergency Drought Barrier (red line) and without the barrier under D1641 compliance (blue line).

Under these conditions, effects on Delta Smelt from changes in conductivity in the lower San Joaquin River are anticipated to be minor because they are within physiological tolerance ranges for salinity in which Delta Smelt are captured (Nobriga et al. 2008; Figure 13). With X2 positioned above the Sacramento-San

Joaquin confluence, it is possible that salinities downstream may reach levels that are less suitable for juvenile Delta Smelt and prevent substantial seaward movement to areas where the marine influence and larger water bodies maintain cooler water temperatures, although EC values at Collinsville (Figure 25) are projected to remain below levels at which 100% survival occurred in laboratory salinity tolerance studies (Komoroske et al. 2014).

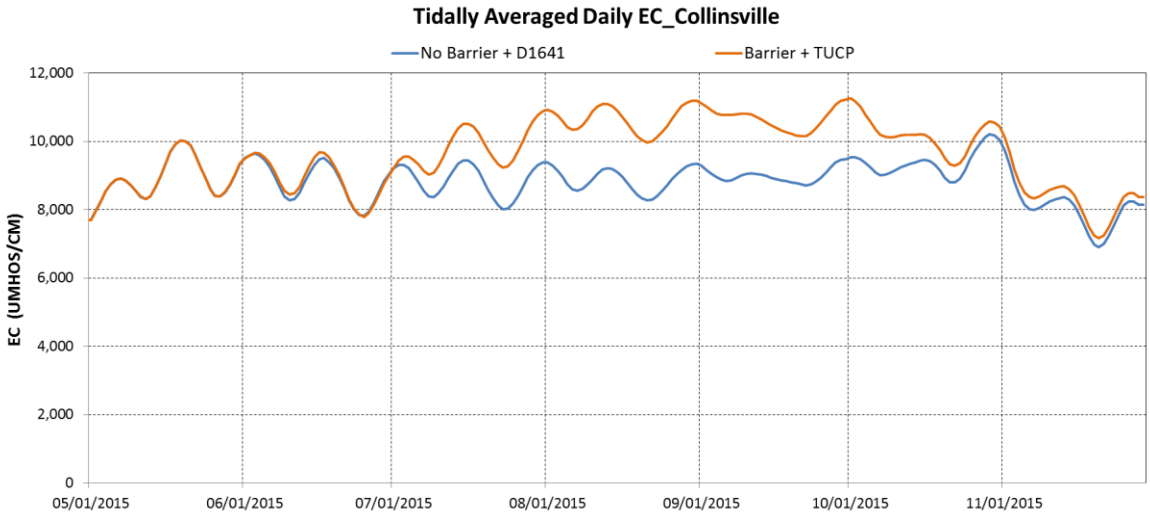


Figure 25. Forecasted flow at Collinsville, based on April 90% forecast from DSM2 models under TUCP conditions with the West False River Emergency Drought Barrier (red line) and without the barrier under D1641 compliance (blue line).

Hydrodynamic Effects on Entrainment

The proposed modifications will result in lower outflows that may reduce survival of out-migrating juvenile Delta Smelt that are currently in the interior Delta. For example, lower flows increase migration time and increase exposure to degraded habitats and predators. However, the projected OMR flows are at minimum levels and therefore are not likely to directly result in substantial additional impacts over unmodified conditions. For smelt residing in the North Delta, reduced outflow, while limiting the available habitat and its quality, is not expected to result in increased risk of entrainment. There is a low level of uncertainty in this conclusion.

Food Availability

Prey availability is constrained by habitat use, which in turn affects what types of prey are encountered. Delta Smelt are visual feeders. They find and select individual prey organisms and their ability to see prey in the water is enhanced by turbidity (Baskerville-Bridges et al. 2004). Thus, Delta Smelt diets are largely comprised of small invertebrates (i.e., zooplankton) that inhabit the estuary's turbid, low-salinity, open-water habitats. Larval Delta Smelt have particularly restricted diets (Nobriga 2002). They do not feed on the full array of zooplankton

with which they co-occur and primarily consume three copepods: *Eurytemora affinis, Pseudodiaptomus forbesi,* and freshwater species of the family Cyclopidae, which inhabit the North Delta region. Further, the diets of Delta Smelt larvae are largely restricted to the larval stages of these copepods. As Delta Smelt grow larger their mouth gape increases and their swimming ability strengthens, enabling them to target larger copepods.

In the laboratory, a turbid environment (>25 Nephelometric Turbidity Units [NTU]) was necessary to elicit a first-feeding response in larval Delta Smelt (Baskerville-Bridges et al. 2000; Baskerville-Bridges 2004). Successful feeding seems to depend on a high density of food organisms and turbidity, and success increases with stronger light conditions (Baskerville-Bridges et al. 2000; Mager et al. 2004; Baskerville-Bridges et al. 2004). Variability of shallow and deep water habitat and resuspension of sediment due to wind and tidal action in the North Delta may buffer effects of the proposed modifications because much of the habitat in this region would remain suitable. Expectations for the North Delta contrast with the lower San Joaquin River where the upstream relocation of X2 may result in a greater proportion of the available habitat encompassing areas of high semi-aquatic vegetation and associated low turbidities. This could result in lower prey availability and higher predation rates on juvenile Delta Smelt. There is moderate level of uncertainty in this conclusion.

In addition to turbidity, changes in flow may affect residence time, which in turn may influence planktonic production. Lower flows are expected to increase hydraulic residence times, potentially resulting in improved planktonic production (Lucas et al. 2009). However, a specific effect is difficult to predict because benthic grazing can offset these benefits and hence the response of the food web to changes in flow is unclear. There is a high level of uncertainty about this conclusion.

Summary of Delta Smelt Effects

Adult Delta Smelt

If the recent SKT survey results reasonably reflect the current distribution of Delta Smelt, there is an absence of adult Delta Smelt in the central and south Delta (SKT #4). Entrainment of adults is unlikely to be a management issue for the rest of this year. Published analyses of a 13-year dataset of salvage records at the CVP/SWP fish collection facilities indicate that increased salvage of adult Delta Smelt at the CVP/SWP occurs when turbidities increase in the South Delta and Old and Middle River flows are highly negative (Grimaldo et al. 2009). Given the present low level of pumping and low turbidity in the South Delta, movement of remaining adults into areas of elevated entrainment risk is not expected. The salvage of adult Delta Smelt typically ends by May (Figure 26). After the onset of spawning, salvage of adults diminishes, with the regulatory

focus shifting to protection of larvae/juveniles by the end of March (as determined by water temperatures or biological triggers; FWS BO 2008).

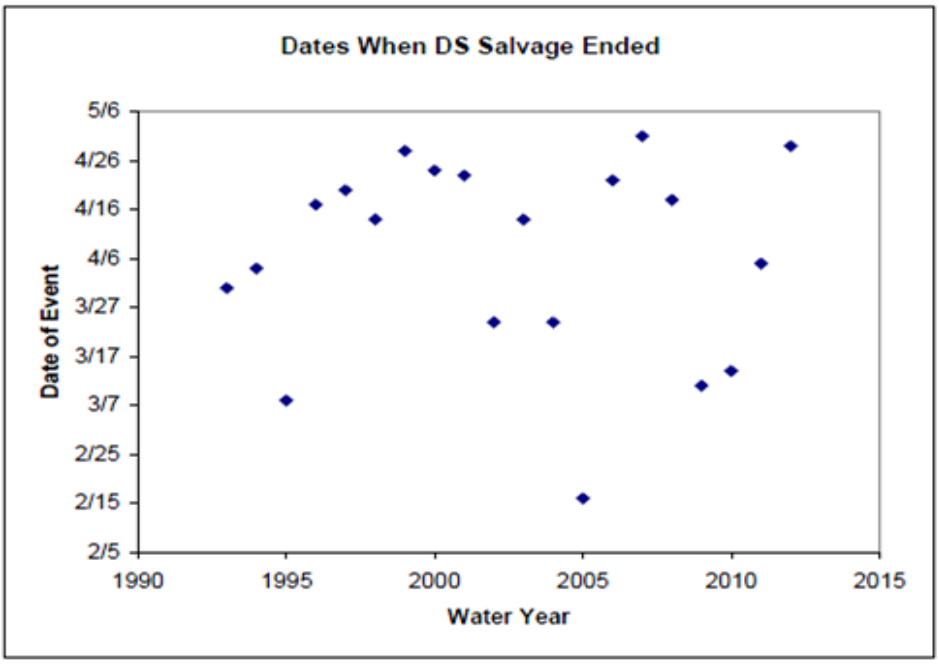


Figure 26. Dates of salvage for last adult Delta Smelt in water years (WY) 1993-2012[10]. Latest dates of adult Delta Smelt salvage in WY 2013-2015 were 3/25/13 in WY 2013, none salvaged in 2014, and 2/21/15 to date in WY 2015.

Some two-year-old fish survive through the summer to spawn the following year (Figure 27), but this is uncommon (2.3% to 9.3% of population in 2002 and 2003, respectively; Bennett 2005). Although the proportion of fish in this category is typically small, these age 1+ Delta Smelt produce more eggs than age 1 adults and have a disproportionate effect on the population (Bennett 2005). We hypothesize that these age 1+ fish will have a greater ability to move out of areas of poor habitat quality due to their size and broader salinity tolerance, and thus will be more likely to survive compared to juvenile Delta Smelt (discussed below). For these reasons the remainder of our discussion regarding Delta Smelt during the summer will focus on effects on larvae and juveniles.

[10] Graph provided by Robert Fujimura, CDFW, on 1/14/13.

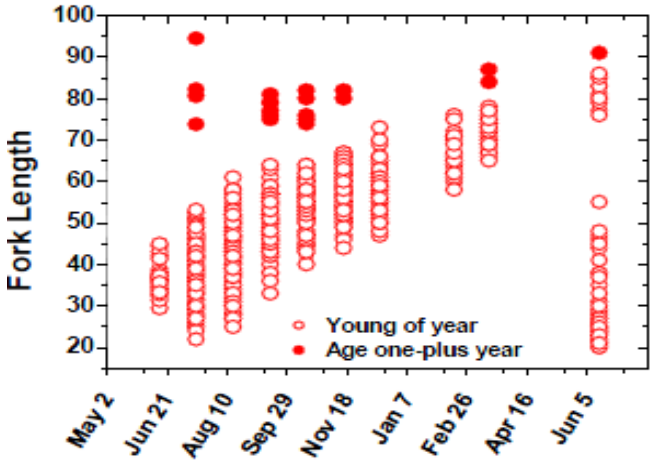


Figure 27. Length of young-of-year and 1+ adults determined from Otolith evaluations (n=876) in 1999-2000[11]

Larval-Juvenile Delta Smelt

San Joaquin River

The distribution of newly hatched larval Delta Smelt in the lower San Joaquin River is assumed to be similar to the distribution of adults, which are not currently present and therefore not at a high risk of entrainment. Recent larval survey results further support this assumption (see above). The entrainment risk of larval Delta Smelt produced in the lower San Joaquin River is expected to be moderated by the maintenance of Index OMR flows substantially less negative than -5000 cfs on a 14-day running average under the proposed action for the duration of the RPA action. There is potential that undetected larval Delta Smelt are located in the South Delta closer to the export facilities and these may be at a higher risk of entrainment. However, based on simulated fates of neutrally buoyant particles (Kimmerer and Nobriga 2008), any Delta Smelt southeast of Jersey Point in the Central/South Delta may be entrained at the south Delta export facilities even at minimum export levels. There is a low level of uncertainty about this conclusion.

Salvage of juvenile Delta Smelt during the summer and fall months is reported to be virtually non-existent (Table 8; CDFW Salvage data), as they do not use the South Delta as habitat during these months (Sommer et al. 2011).

[11] Bennett 2005.

Table 8. Date of last juvenile Delta Smelt salvaged for water year[12]

Facility	2008	2009	2010	2011	2012	2013	2014
CVP	6/20	6/23	5/21	N/A	6/23	6/8	5/13
SWP	7/5	6/30	6/8	N/A	6/28	6/17	5/3

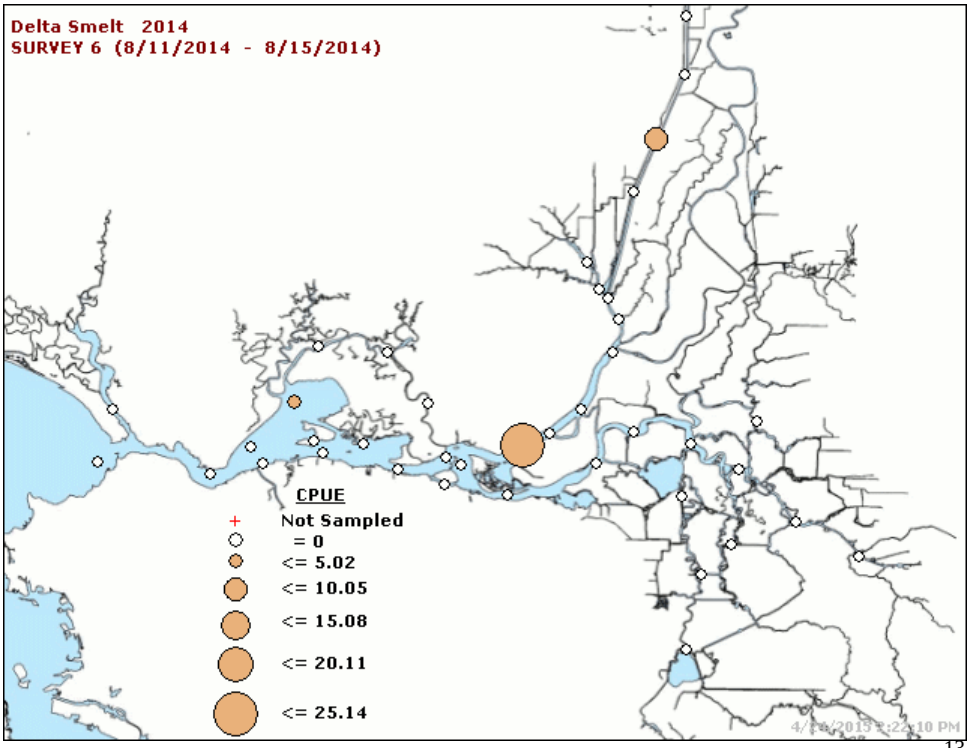


Figure 27. Townet Survey #6 Delta Smelt Distribution in mid-August[13] **Catch per unit effort (CPUE) was the number of fish caught per 10,000 cubic meters of water sampled.**

Sacramento River/North Delta

Juvenile Delta Smelt during the summer period typically reside in the LSZ around X2, with a substantial portion of the population remaining in the North Delta (Sommer and Mejia 2013). The CDFW Summer Townet Survey (TNS) samples the distribution of Delta Smelt throughout the summer and early fall period, and in the summer of 2014 consistently detected Delta Smelt in both of these areas (Figure 27). It is thought that Delta Smelt in the Cache Slough Complex use deep water areas of Cache Slough and the Sacramento Deep Water Ship Channel as thermal refuges during high summer temperatures. Delta Smelt continue to feed and grow throughout summer months and begin to move upstream in early winter

[12] Retrieved from <http://www.dfg.ca.gov/delta/apps/salvage/SalvageExportCalendar.aspx> on 4/24/15.
[13] Retrieved from <http://www.dfg.ca.gov/delta/projects.asp?ProjectID=TOWNET> on 4/24/15.

during periods of increased outflow and high turbidities, which typically do not commence until December. There is no evidence that substantial upstream movement relative to the salt field occurs prior to this period (Sommer et al. 2011).

Juvenile Delta Smelt have the potential to be substantially affected by the proposed actions. The effects of changes in water quality in areas such as Liberty Island, Sacramento Deep Water Ship Channel, Lindsey and Cache Sloughs, are uncertain because the hydrology of this region is strongly driven by tidal effects during the months of the proposed action. However it is relatively likely that reduced inflow will result in a more upstream distribution of Delta Smelt, increasing the risk that they will be exposed to relatively high water temperatures (e.g., >25C). In laboratory temperature tolerance studies (Komoroske et al. 2014) juvenile Delta Smelt tolerated waters several degrees warmer than adults and post-spawn adults, and thus may be more resilient to temperatures between 25-28C than previously thought. Further, it is thought the Deep Water Ship Channel and Cache Slough may provide key thermal refuges that allow Delta Smelt to persist in the North Delta. Nonetheless, it is not known how long these refuges will persist under conditions of a sustained heat wave.

Delta Smelt have a strong positive association with the position of X2, with more downstream positions providing higher quality habitat (Feyrer et al. 2011). Under the proposed action, it is likely that summer Delta Smelt distributions will not be in areas optimal for growth and survival (Nobriga et al. 2008). In previous low-flow years, when water quality conditions became less tolerable for Delta Smelt in the Cache Slough Complex, the North Delta population appeared to have the capability to move downstream quickly towards the LSZ. It is likely, given the strongly tidal nature of the Cache Slough Complex, that Delta Smelt are able to ride these tidal flows and are capable of quickly escaping unfavorable habitat conditions in the North Delta. Under the current proposal, X2 would move further upstream, limiting potential downstream movement, although conditions without the modifications would also limit potential downstream movement. The proportion of the total population of Delta Smelt in the North Delta in summer appears to be highly variable (James Hobbs, UC Davis, unpublished data), but it can be substantial. There is a moderate level of uncertainty about the expected effects in the North Delta.

Biological Review of Longfin Smelt

Longfin Smelt Status and Distribution

In Bay Study trawls conducted during early January, 2015, the majority of adult Longfin Smelt were detected in Suisun Bay, the Confluence area, and the lower Sacramento River (Figure 28). By early April, the distribution was shifted westward, with catch occurring in San Pablo Bay and the Confluence area (Figure 29). No adult Longfin Smelt have been collected in salvage or in the Central or South Delta in the Bay Study sampling, from January-April 2015.

Fish surveys, including the Early Warning Monitoring that occurred at Jersey Point, and salvage suggest there were Longfin Smelt spawning in the West, North and South Delta this year (Figures 28 and 32). Based upon the most recent 20mm survey data the majority of juvenile Longfin Smelt appears to be distributed in the lower Sacramento near the confluence and in Montezuma Slough and with lower densities in near Franks Tract in the South Delta (Figures 30 and 31).

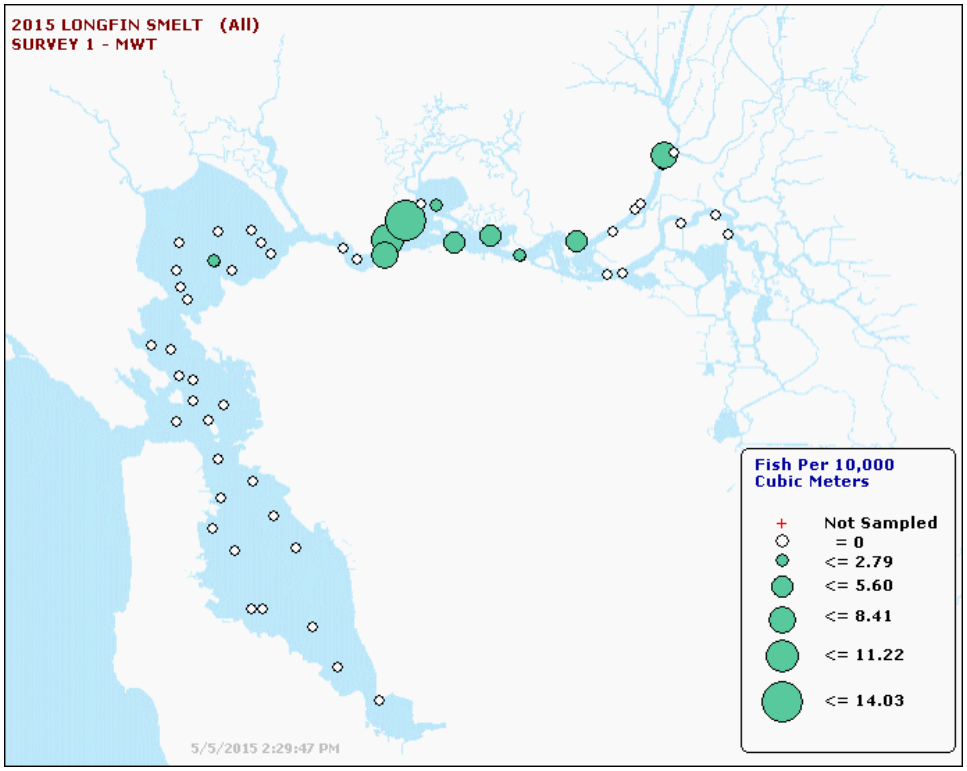


Figure 28. Distribution of adult Longfin Smelt in the Bay Study Midwater Trawl during January 2015.

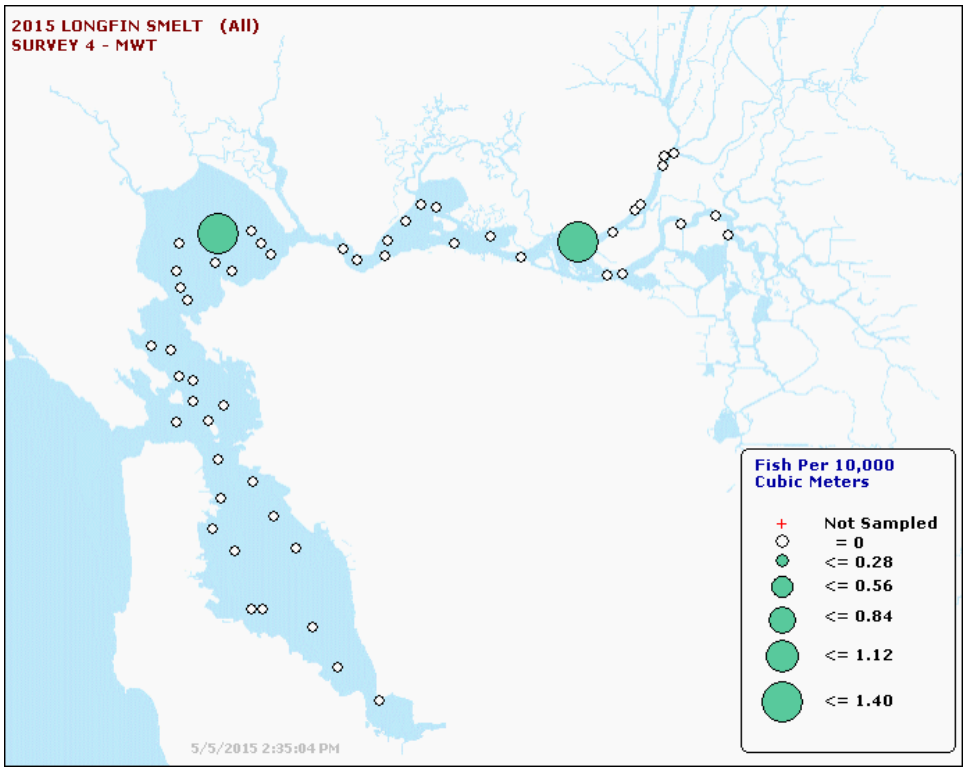


Figure 29. Distribution of adult Longfin Smelt in the Bay Study Midwater Trawl during April 2015.

Longfin Smelt larvae were detected at 4 of 12 Lower San Joaquin River (SJR) and South Delta sampling stations during Smelt Larva Survey #4, conducted February 17-19, 2015 (Figure 32). However, subsequent Smelt Larva Survey sampling indicated densities of Longfin Smelt larvae in the South Delta diminished in following weeks while densities increased in the lower SJR (Figure 33).

While larvae in these southern areas will be at risk of entrainment during operations due to their proximity to the export facilities, the minimal export levels should result in a low level of risk. In addition, larvae in the south Delta only represent approximately 3.5% of the total larval catch in SLS #6 east of Carquinez Straights based upon Catch Per Unit Effort (CPUE). Larvae were initially detected at the CVP and SWP salvage facilities, (on February 27 and March 3, respectively). Detection of age-0 Longfin Smelt in larval fish sampling at the facilities continued to be intermittent in March and increased to near daily detections during the latter half of April (Figure 34).

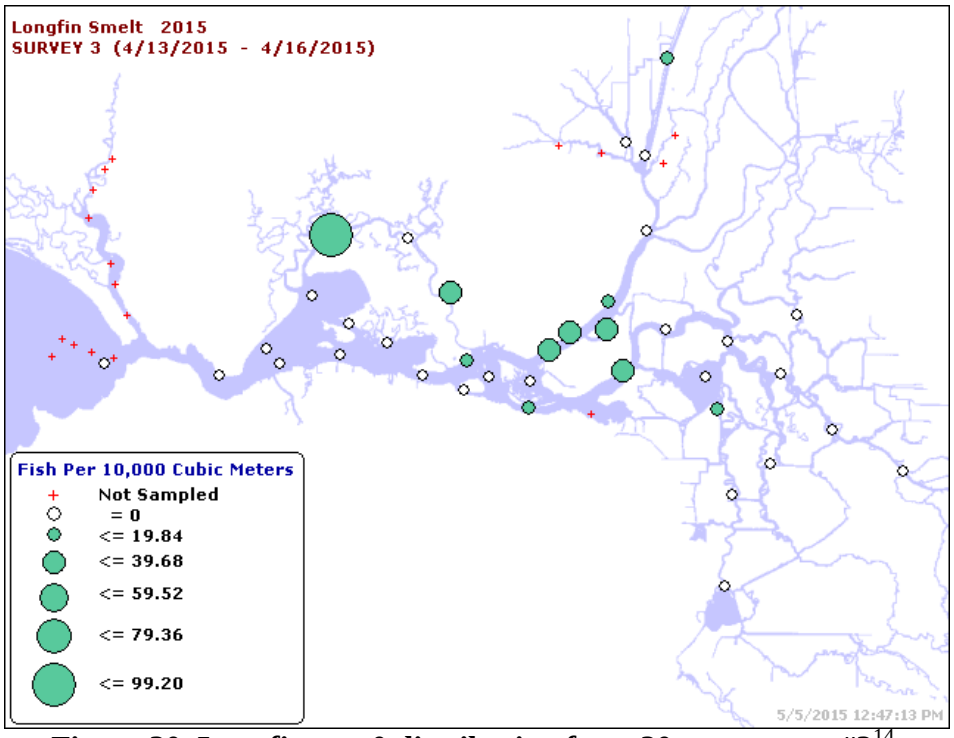


Figure 30. Longfin age-0 distribution from 20 mm survey #3[14].

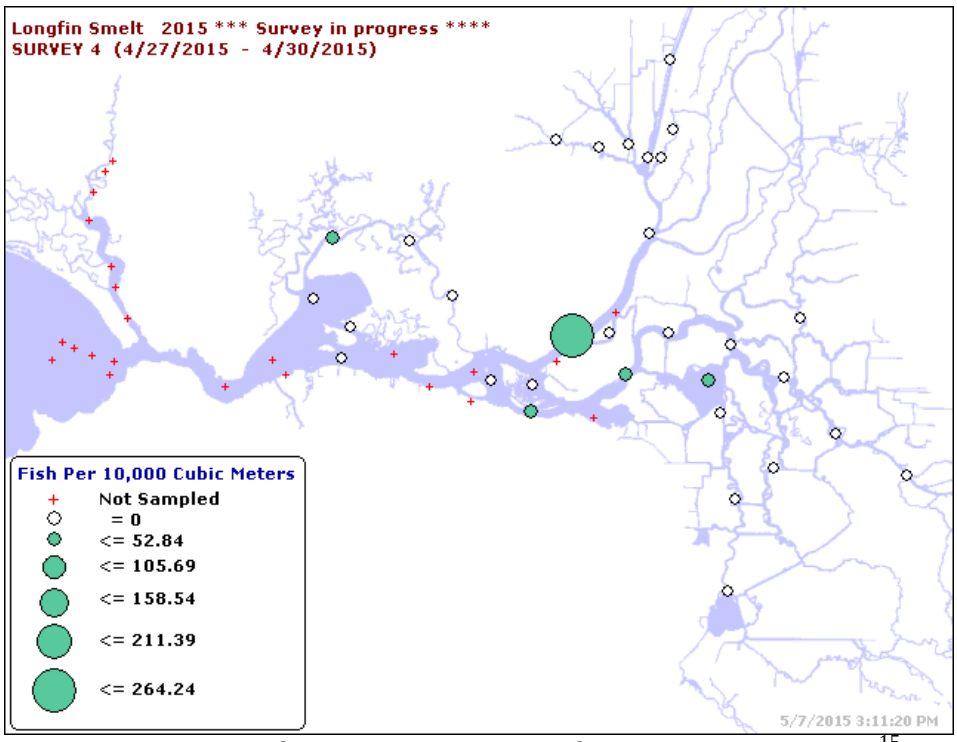


Figure 31. Longfin age-0 distribution from 20 mm survey #4[15].

[14] Retrieved from http://www.dfg.ca.gov/delta/data/ on 5/05/15
[15] Retrieved from http://www.dfg.ca.gov/delta/data/ on 5/07/15

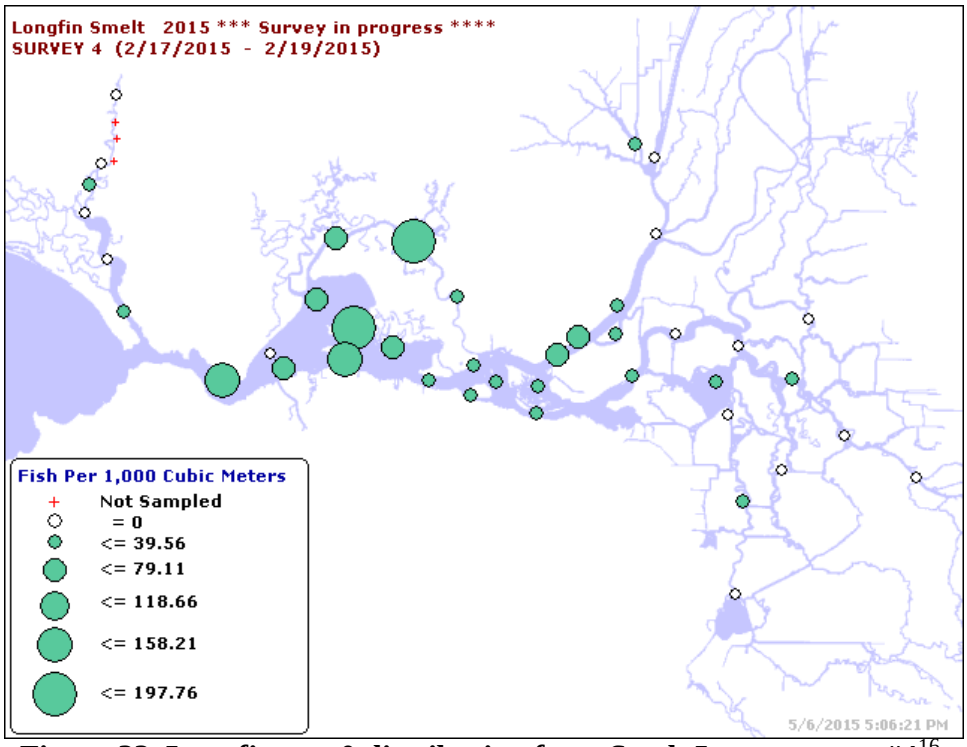
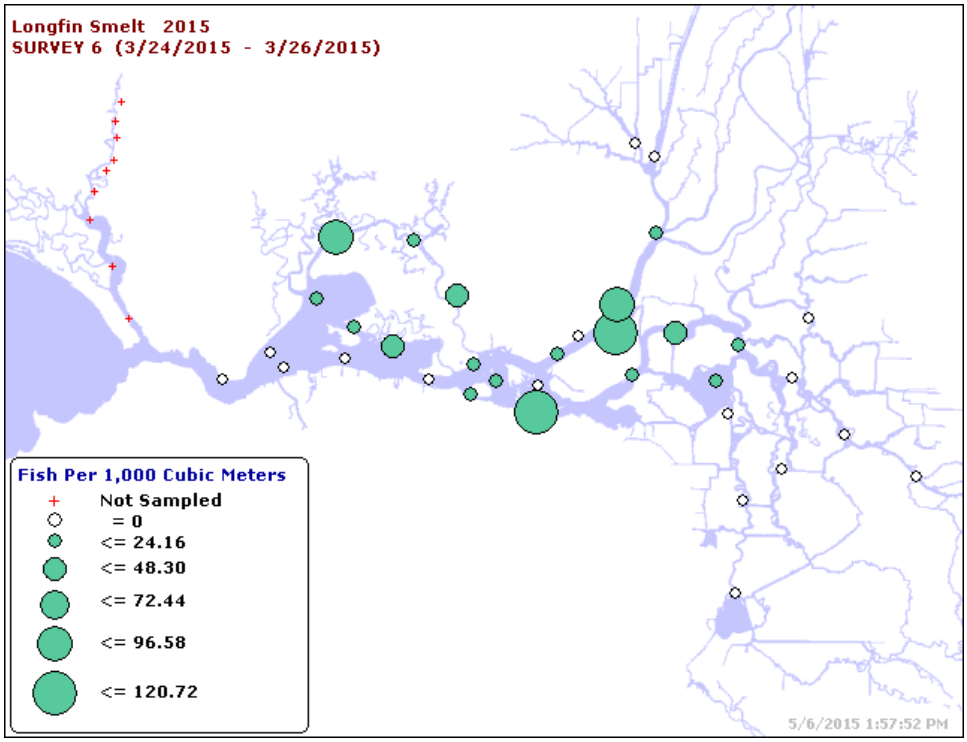


Figure 32. Longfin age-0 distribution from Smelt Larva survey #4[16].



[16] Retrieved from http://www.dfg.ca.gov/delta/data/ on 5/05/15

Figure 33. Longfin age-0 distribution from Smelt Larva survey #6[17].

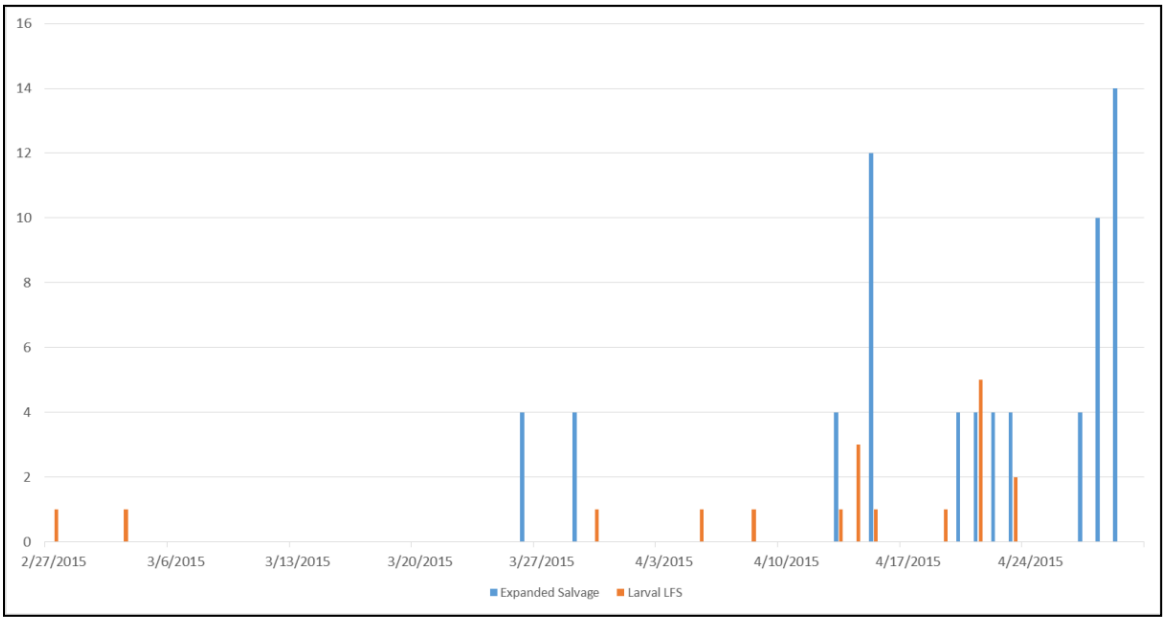


Figure 34. juvenile counts are expanded salvage, larval counts are raw sample numbers, water year 2015[18].

Longfin Smelt Effects

Adult Longfin Smelt

In WY2015 no adult Longfin smelt were observed at the salvage facilities. Based on salvage data from WY1994 through WY2015 the first 5% of total yearly salvage typically occurs in early February, and salvage of any Longfin smelt prior to December occurred in only one year during the past 21 years (WY2001). Longfin smelt migration does not appear to correlate with any single environmental variable, and the population may have a more generalized seasonal migration response. Therefore, there is potential for some migration to occur during the end of the currently proposed action with or without the occurrence of any change in predicted environmental conditions, such as a large precipitation or flow event although the probability of a large migration event during the period of the proposed actions is low. There is a moderate level of certainty in this conclusion.

Larval-Juvenile Longfin Smelt

Given the limited distribution of larvae and juveniles in the Central and South Delta, and the very low levels of projected exports, the proposed action will not substantially raise the entrainment risk of the Longfin Smelt population. The

[17] Retrieved from http://www.dfg.ca.gov/delta/data/ on 5/05/15
[18] Retrieved from http://www.dfg.ca.gov/delta/apps/salvage/Default.aspx on 4/30/15

maximum change in daily tidal flow at Jersey Point resulting from the proposed actions is less than 500cfs, and for the majority of the period the change is less pronounced (Figure 17). Additionally, larval Longfin Smelt salvage has historically decreased as south Delta water temperatures rise in the spring months. Therefore salvage is likely to continue declining through the action period, and little increase in entrainment effects on BY2015 Longfin Smelt resulting from the proposed actions are expected. However, a demonstrated positive relationship between Longfin Smelt abundance and winter-spring Delta outflow (Kimmerer 2002; Rosenfeld and Baxter 2007) suggests reduced outflow in April under the proposed action will result in some reduction in overall abundance. Furthermore, the operation of West False River Emergency Drought Barrier has the potential to delay or inhibit westward migration of juvenile longfin that were in the Franks Tract area and regions further south. The modifications proposed are not likely to result in a substantial degradation of rearing habitat for Longfin Smelt over conditions that would be experienced in a dry year. There is a moderate level of certainty about this conclusion.

Summary of Effects on Longfin Smelt

Like other species, inhabiting the Delta, Longfin Smelt are likely to experience poor recruitment this year due to effects of the continuing drought. Low spawning and larval detection rates this year seem to support these predicted low survival rates. The reduction in outflow due to the proposed action may have some negative impact on Longfin spawning and recruitment, though this effect is hard to quantify given the already poor environmental conditions due to the drought.

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