

# Weekly Assessment of CVP and SWP Delta Operations on ESA-listed Species

## **Executive Summary**

### **a) Operations anticipated during the week**

See Weekly Fish and Water Operation Outlook document for April 19 – April 25

### **b) Winter-run Chinook Salmon summary**

Loss of natural winter-run Chinook Salmon (by length at date, LAD) has occurred in the past week at the fish salvage facilities (WY 2022 total loss = 73.04 fish, as of 4/17/2022). Loss of natural winter-run Chinook Salmon at the Central Valley Project (CVP) and State Water Project (SWP) fish collection facilities could occur over the next week based on hydrology and recent observations. Loss of hatchery winter-run Chinook salmon has not occurred in the past week at the fish salvage facilities (WY 2022 total loss = 6.71 fish, as of 4/17/2022). 25-58% of juvenile natural winter-run Chinook Salmon from brood year (BY) 21 are estimated to be present in the Delta. The Delta Cross Channel (DCC) gates closure for the season reduces exposure of winter-run Chinook Salmon juveniles that are present in the Sacramento River near the DCC gates into the interior Delta.

### **c) Spring-run Chinook salmon summary**

Juvenile natural spring-run Chinook Salmon from BY 21 are migrating past the DCC gates. The exposure and effects of DCC closure are unlikely for natural spring-run Chinook Salmon. Length-at-date spring run were observed in the Delta within the previous seven days. Larger, older juveniles were observed that may be yearling spring run. Natural spring-run Chinook salmon have been observed at the fish collection facilities. 60-75% young of year spring-run Chinook Salmon are estimated to be in the Delta.

### **d) Central Valley Steelhead summary**

Loss of natural Central Valley California (CCV) steelhead has occurred in the past week at the State and Federal fish salvage facilities (WY 2022 total loss December through March = 84.28 fish and WY 2022 total loss April through June = 72.0 fish, as of 4/17/2022). Loss of Central Valley steelhead at the Central Valley Project (CVP) and State Water Project (SWP) fish collection facilities could possibly occur over the next week. 25-40% of juvenile CCV Steelhead are estimated to be present in the Delta. Closure of the DCC gates for the season will reduce exposure to Central Valley steelhead juveniles that are potentially present in the Sacramento River near the DCC gates.

**e) Green Sturgeon summary**

Loss of green sturgeon has not occurred in the past week at the State and Federal fish salvage facilities (WY 2022 total loss = 0 fish, as of 4/17/2022). Loss of green sturgeon is unlikely to occur over the next week due to their rare presence in the South Delta.

**f) Delta Smelt summary**

Based on recent detections, Delta Smelt are present in the OMR Corridor. Detection data support Delta Smelt also being present in the Sacramento Deep Water Ship Channel, Lower Sacramento, and Suisun Marsh. Seven larval Delta Smelt were collected since 4/12/2022. Larval Delta Smelt have been detected in the lower San Joaquin, Lower Sacramento, Old River, the confluence and the North Delta. Larval Delta Smelt in the OMR corridor have an increased likelihood of entrainment.

**g) Monitoring Teams summary**

There were no non-consensus issues to report from the Salmon Monitoring Team.

There were no non-consensus issues to report from the Smelt Monitoring Team.

## **Operational and Regulatory Conditions**

See current Weekly Fish and Water Operation Outlook document.

## **Biology, Distribution, and Evaluation Winter-run Chinook salmon, Spring-run Chinook salmon, Central Valley Steelhead**

### **POPULATION STATUS**

#### **Winter-run Chinook salmon**

##### **Delta Life Stages:**

Juveniles, Adults

##### **Brood Year 2021 Productivity:**

- Natural winter-run Chinook salmon: A draft juvenile production estimate (JPE) calculation has been established for brood year (BY) 2021 winter-run Chinook salmon. The final winter-run Chinook salmon JPE is 125,038 fish. Among other topics, the group discussed the thiamine vitamin deficiency that is being observed again in broodstock at the Livingston Stone NFH similar to last year's observation. Last year the thiamine vitamin deficiency appeared to negatively affect survival of juvenile fish as they migrate downstream towards the Delta. Mean cumulative weekly passage of winter-run Chinook salmon through 4/8/2022 for the last 19 years of passage data is 99.9% (one SD of 0.1%). By 3/25/2022, 572,295 winter-run Chinook salmon were estimated to have passed RBDD compared to the cumulative passage last year of 3,813,580 winter-run Chinook salmon.
- Hatchery winter-run Chinook salmon:
  - Approximately 123,975 Livingston Stone NFH brood year 2021 winter Chinook salmon were released at dusk on 2/9/2022 into the Sacramento River at Caldwell Park in Redding, CA. This is the first release of LSNFH brood year 2021 winter Chinook salmon comprising of approximately 24% of the total hatchery production for the Sacramento River supplementation program. The release group is 100% marked (adipose-fin clip and CWT) with an overall estimated average fork length of 85mm. There has been loss this water year with this release group. Some fish from this group were acoustically tagged and are being tracked (Table 6).
  - Approximately 396,310 LSNFH brood year 2021 winter Chinook salmon were released at dusk on 3/2/2022 into the Sacramento River at Caldwell Park in Redding, CA. This is the second release of LSNFH brood year 2021 winter Chinook salmon. The release group is 100% marked (adipose-fin clip and CWT) with an overall estimated average fork length of 85mm. There has

not been loss this water year with this release group. Some fish from both groups were acoustically tagged and are being tracked (Table 6).

- Approximately 136,958 Coleman NFH Complex brood year 2021 winter Chinook salmon were released 3/16/2022 and 3/17/2022 on the North Fork Battle Creek. The release group is 100% marked (adipose fin-clip and a left pelvic-fin clip and CWT) with an overall estimated average fork length of 85mm.

### **Spring-run Chinook salmon**

#### **Delta Life Stages:**

Young-of-year (YOY) and Yearlings

#### **Brood Year 2021 Productivity:**

- Natural spring-run Chinook salmon: No JPE has been established for spring-run Chinook salmon. Approximately 66.1% juvenile spring-run sized Chinook salmon have been observed passing Red Bluff Diversion dam as of 4/10 based on historical data.
- Hatchery spring-run Chinook salmon surrogates associated with the Proposed Action (PA 4.10.5.10.2 Additional Real-Time OMR Restrictions and Performance Objectives):
  - Approximately 84,343 late-fall Chinook salmon from Coleman NFH were released at Battle Creek on 12/15/2021. This group is 100% marked with adipose-fin clip and CWT and have an estimated average fork length of 145mm. This is the first spring-run Chinook salmon surrogates release group associated with the Proposed Action. There has been loss this water year of fish associated with the first surrogate release group.
  - Approximately 82,626 late-fall Chinook salmon from Coleman NFH were released at Battle Creek on 12/22/2021. This group is 100% marked with adipose-fin clip and CWT and have an estimated average fork length of 125mm. This is the second spring-run Chinook salmon surrogates release group associated with the Proposed Action. There has been loss this water year of fish associated with the second release group.
  - Approximately 77,325 late-fall Chinook salmon from Coleman NFH were released at Battle Creek on 1/6/2022. This group is 100% marked with adipose-fin clip and CWT and have an estimated average fork length of 145mm. This is the third spring-run Chinook salmon surrogates release

group associated with the Proposed Action. There has been loss this water year of fish associated with the third release group.

- An additional Coleman National Fish Hatchery (CNFH) hatchery surrogate group was released on 4/5/2022 and 4/7/2022 which totaled 339,094 fall-run (FR) of which 339,094 FR were marked with an adipose fin clip and CWT.
- Hatchery spring-run Chinook salmon surrogates associated with the ITP (Condition Of Approval 8.6.4):
  - Approximately 2.8 million (2,865,384) fall-run Chinook salmon from Coleman NFH were released into Battle Creek on 3/15/2022. This group is 25% marked (adipose-fin clip and CWT) and 75% unmarked and has an estimated fork length of 75mm. This is the first release from Coleman NFH associated with ITP COA 8.6.4.
  - Approximately 3.0 million (2,982,466) fall-run Chinook salmon from Coleman NFH were released into Battle Creek on 3/18/2022. This group is 25% marked (adipose-fin clip and CWT) and 75% unmarked and has an estimated fork length of 75mm. This is the second release from Coleman NFH associated with ITP COA 8.6.4.
  - Approximately 1,458,758 brood year 2021 spring-run Chinook salmon from Feather River Fish Hatchery will be released into the Feather River at Gridley and Boyd's pump on 3/30/2022. This group is 50% tagged (adipose fin clip and CWT) and has an estimated fork length of 68 mm. This is the first release group from Feather River Fish Hatchery associated with ITP COA 8.6.4.
  - Approximately 4.22 million brood year 2021 fall-run Chinook salmon from Coleman NFH were released between 3/31/2022 and 4/1/2022 at Battle Creek. This group is 25% marked (adipose fin clip and CWT) and 75% unmarked and has an estimated fork length of 75mm. This is the third release group from Coleman NFH associated with ITP COA 8.6.4.
- San Joaquin River Restoration Program (SJRRP) Salmon Conservation and Research Facility (SCARF) Chinook salmon:
  - Approximately 57,478 brood year 2021 spring-run Chinook salmon from the SJRRP SCARF were released on 2/14/2022 into the San Joaquin River at Fremont Ford Bridge (Highway 140). This release consisted of marked juveniles (adipose fin clip and CWR) and have an estimated average fork length of 85mm.

- The agencies in the SaMT discussed the thiamine vitamin deficiency that was observed in winter run Chinook salmon broodstock at the Livingston Stone NFH in BY 2021. Last year the thiamine deficiency appeared to negatively affect survival of juvenile fish as they migrate downstream towards the Delta. The thiamine deficiency issue is also likely impacting spring-run Chinook salmon. Although the egg take goals have been met at the Feather River Fish Hatchery, they are still experiencing fertility issues that are impacting production.

## **Central Valley Steelhead**

### **Delta Life Stages:**

- Spawning Adults, Kelts, Juveniles

### **Brood Year 2021 Productivity:**

- Spawner abundance: There is limited information about the adult steelhead population. It is estimated to be small, contributing to the limited productivity of the population
- Natural steelhead: No JPE has been established for steelhead. Data are limited.
- Hatchery steelhead: Reclamation's Proposed Action has no hatchery steelhead triggers.
  - Approximately 610,911 steelhead from Coleman NFH were released at Battle Creek from 12/12/2021 to 12/13/2021. This group is 100% marked only (with an adipose-fin clip) and has an estimated average fork length of 195mm.
  - Approximately 57,056 steelhead from Mokelumne River Fish Hatchery will be released into the Mokelumne River at Feist Ranch from 1/31/2022 to 2/1/2022. This group is 100% marked (CWT and adipose fin clip) and has an estimated average fork length of approximately 210mm.
  - Approximately 424,000 steelhead from Nimbus Fish Hatchery will be released into the Lower American River at the Sunrise Boat Ramp from 1/31/2022 through 2/4/2022. This group is 100% marked (adipose fin clip) and has an average fork length of approximately 240mm.
  - Approximately 475,000 steelhead from Feather River Fish Hatchery will be released into the Feather River at Boyd's Pump from 2/4/2022 through 2/11/2022. This group is 100% marked (adipose fin clip) and has an average fork length of approximately 210mm.

- Approximately 60,000 steelhead from Mokelumne River Fish Hatchery will be released into the Mokelumne River at Feist Ranch from 2/28/2022 through 3/1/2022. This group is 100% marked (adipose fin clip) and has an average fork length of approximately 210mm.
- Approximately 50,000 steelhead from Mokelumne River Fish Hatchery will be released into the Mokelumne River at Feist Ranch from 4/4/2022 through 4/5/2022. This group is 100% marked (adipose fin clip and right maxillary clip) and has an average fork length of approximately 230mm.

## DISTRIBUTION

### Winter-run Chinook Salmon

#### **Current Distribution:**

- On 4/19/2022, SaMT estimated 25-58% of juvenile winter-run Chinook salmon were present in the Delta and 40-75% were estimated to have exited the Delta (Table 1). The SaMT estimate is based both on historical trends and observations of recent monitoring. The SaMT expressed some concern that these numbers seem low especially given the precipitation events that occurred early in the Water Year (October and December 2021).
- Combined total natural winter-run Chinook salmon loss equals 73.04 fish (as of 4/17/2022).
- Combined total hatchery winter-run Chinook salmon loss equals 6.71 fish (as of 4/10/2022).
- Fish have been steadily arriving since the beginning of October 2021.
- Winter-run Chinook Salmon have not been observed in RST monitoring locations over the past week. The fish are no longer be holding in the middle reaches of the Sacramento River and are migrating downstream (Table 2).
- Movement of winter-run Chinook Salmon juveniles into the lower reaches of the Sacramento River and upper Delta is continuing. Mill and Deer creeks daily flows were recorded higher than 95 cfs during the past week.

#### **Historic Trends**

- Based on historical trends in salvage, 97.8% of winter-run Chinook salmon should have been observed in salvage by this time of the water year (Table 3). Loss of natural winter-run Chinook salmon at the CVP and SWP fish collection facilities could occur over the next week based on hydrology and recent observations. If

historic trends in salvage were to continue, winter-run Chinook salmon loss is expected to remain the same over the next week.

- Based on historic loss patterns and historic cumulative loss, it was possible that in WY 2022 50% of the wild winter-run Chinook salmon Delta Performance single-year loss threshold (731.47 wild winter-run Chinook salmon, as set by the JPE estimate) could be exceeded (Figure 1, Operations Outlook Table 2a). However, as the season has progressed only a few years of historical loss would cause exceedance of the WY 2022 single-year loss threshold (WY 2011 and WY 2012). As of this point in the season no years of historical loss would cause exceedance of the WY 2022 single-year loss threshold. Members of the SaMT agree the likelihood of exceeding the next annual loss threshold and loss occurring in the next week is unlikely to lead to exceedance of the threshold.

### **Forecasted Distribution within Central Valley and Delta regions**

- Movement of winter-run Chinook salmon juveniles into the lower reaches of the Sacramento River and upper Delta are likely to occur with precipitation events and increasing river flows and turbidity. The agencies in the SaMT believe precipitation events may occur over the next week (see Ops Outlook). The STARS model projects route-specific proportion of entrainment, survival, and travel times (Table 4). This model does not estimate entrainment into the lower Sacramento River sloughs (i.e., Three-Mile Slough). The DCC gates were closed 11/30/21 and are expected to remain closed through mid-May 2022. If little precipitation is forecasted there may be a need to open the DCC gates to meet D-1641 water quality standards
- The entrainment tool estimates a median loss of 0 fish and a maximum loss of 0 fish during this week (SacPAS last updated on 4/18/2022, Table 5, Figure 2).
- Genetic information from salvaged Chinook salmon results collected at Tracy Fish Collection Facility and Skinner through 1/12/2022. All the samples that were classified, by LAD method, as winter-run Chinook salmon were genetically identified as fall-run Chinook salmon with the exception of one. That fish was genetically identified as a spring-run Chinook salmon but with low probability (0.549). For results refer to Attachment C.
- For results of entrainment into Delta strata regions from DSM2 model runs (North Delta into Interior and Central Delta, San Joaquin River and Central Delta into South Delta, and South Delta into fish facilities) refer to Attachment A.
- For preliminary results of acoustically tagged salmonids currently in the system see Table 6.



### Spring-run Chinook salmon

#### **Current Distribution**

- On 4/19/2022, SaMT estimated 60-75% of young of year CV spring-run Chinook salmon were present in the Delta (Table 1).
- Spring-run chinook are being observed at monitoring sites (Lower Sacramento, Feather River, GCID, Beach Seines, Sacramento Trawls, Chipps Island, Tisdale, Knights Landing, and SKT (stations within both the Suisun Bay & West and Sac River System strata)).

#### **Historical Trends**

- Based on historical trends in salvage, 41.3% of YOY spring-run Chinook salmon were observed in salvage by this time of the water year (Table 3). If historic trends in salvage were to continue YOY spring-run Chinook salmon loss could possibly occur over the next week.

#### **Forecasted Distribution within Central Valley and Delta regions**

- On 4/19/2022 SaMT noted that some juvenile CV YOY spring-run Chinook Salmon have yet to emerge. Yearling CV spring run Chinook Salmon are moving out from natal tributaries. Mill and Deer creek flows continue to exceed 95 cfs indicating that yearling spring-run Chinook Salmon may begin to move and migrate into the mainstem Sacramento River (Table 4).
- For results of entrainment into Delta strata regions from DSM2 model runs (North Delta into Interior and Central Delta, San Joaquin River and Central Delta into South Delta, and South Delta into fish facilities) refer to Attachment A.
- For preliminary results of acoustically tagged salmonids in the system see Table 6.

### Central Valley Steelhead

#### **Current Distribution**

- On 4/19/2022 SaMT estimated 25-40% of juvenile CCV steelhead were present in the Delta (Table 1).
- Combined total loss of hatchery steelhead equals 449.48 fish as of 4/17/2022.
- Combined total loss of natural steelhead between December 1 and March 31 equals 84.28 fish as of 4/17/2022.
- Combined total loss of natural steelhead between April 1 and June 15 equals 72.0 fish as of 4/17/2022.

### Historical Trends

- Based on historical trends in salvage, 100% (December through March) of juvenile CCV steelhead should have been observed in salvage by this time of the water year. Based on historical trends in salvage, 47.6% (April through June) of juvenile CCV steelhead should have been observed in salvage by this time of the water year. If historic trends in salvage were to continue, juvenile CCV steelhead loss could possibly increase over the next week.

### Forecasted Distribution within Central Valley and Delta regions

- Natural steelhead were observed in key monitoring locations this past week (Beach Seines).
- SaMT estimated that 25-40% of the population of CCV steelhead may be present in the Delta at this time. Closure of the DCC gates for the season will reduce exposure and possible entrainment of juvenile CCV steelhead into the interior Delta via the DCC gates.
- The entrainment tool estimates a median loss of 17 fish and a maximum loss of 75 fish during this week (SacPAS last updated on 4/18/2022, Table 5, Figure 2).
- For results of entrainment into Delta strata regions from DSM2 model runs (North Delta into Interior and Central Delta, San Joaquin River and Central Delta into South Delta, and South Delta into fish facilities) refer to Attachment A.

TABLE 1. Salmonid distribution estimates

Location	Yet to Enter Delta	In the Delta	Exited Delta past Chipps Island
Young-of-year (YOY) winter-run Chinook salmon	0-2%	25-58%	40-75%
YOY spring-run Chinook salmon	5-10%	60-75%	20-30%
YOY hatchery winter-run Chinook salmon	0-1%	9-20%	80-90%
Natural origin steelhead	5-10%	25-40%	50-70%

TABLE 2. Historic migration and salvage patterns.

Date (4/17)	Red Bluff Diversion Dam	Tisdale RST	Knights Landing RST	Sac Trawl (Sherwood) Catch Index	Chippis Island Trawl Catch Index	Salvage
Chinook, Winter-run, Unclipped	99.9% (99.9%,100.0%) BY: 2012 - 2020	100.0% (100.0%,100.0%) BY: 2012 - 2020	99.8% (99.4%,100.3%) BY: 2013 - 2020	94.5% (84.4%,104.6%) BY: 2012 - 2020	94.6% (88.9%,100.3%) BY: 2012 - 2020	97.8% (95.5%,100.2%)
Chinook, Spring-run, Unclipped	83.6% (71.5%,95.6%) BY: 2012 - 2020	95.6% (93.0%,98.2%) BY: 2012 - 2020	88.6% (77.6%,99.7%) BY: 2013 - 2020	78.0% (67.1%,89.0%) BY: 2012 - 2020	43.9% (27.7%,60.2%) BY: 2012 - 2020	41.3% (24.2%,58.3%)
Steelhead, Unclipped (April - June)	N/A	N/A	N/A	N/A	N/A	47.6% (30.9%,64.4%)

TABLE 3. STARS model output.

Date (4/18/2022)	DCC	Georgiana Slough	Sacramento River	Sutter and Steamboat	Interior Delta
Stock: Late Fall Run	N/A	N/A	N/A	N/A	N/A
Proportion of Entrainment	0	0.3	0.45	0.25	N/A
Survival	N/A	16%	50%	37%	N/A
Travel Time	N/A	18.3d	11.2d	11.5d	N/A
Stock: Winter Run	N/A	N/A	N/A	N/A	N/A
Proportion of Entrainment	N/A	N/A	0.58	0.14 Sutter 0.15 Steamboat	0.13
Survival	N/A	N/A	7%	14% Sutter 8% Steamboat	2%
Travel Time	N/A	N/A	6.7d	6.4d Sutter 6.0d Steamboat	10.0d

TABLE 4. Mean daily flow and percent change (Wilkins Slough, Deer Creek, Mill Creek; cfs from CDEC) and temperature and percent change (Knights Landing; °F from RST).

Date	Mill Creek flow (MLM)	MLM Change	MLM Alert	Deer Creek flow (DCV)	DCV Change	DCV Alert	Wilkins Slough flow (WLK)	Knights Landing temperature (°F)	Alert Triggered
4/17/2022	358.0	13.3%	Flow>95cfs	394.7	35.1%	Flow>95cfs	4947.1	N/A	N/A
4/16/2022	316.1	39.6%	Flow>95cfs	292.2	27.6%	Flow>95cfs	4355.2	N/A	N/A
4/15/2022	226.5	20.3%	Flow>95cfs	229.1	38.7%	Flow>95cfs	4091.9	N/A	N/A
4/14/2022	188.3	5.8%	Flow>95cfs	165.2	3.3%	Flow>95cfs	4091.2	N/A	N/A
4/13/2022	178.0	-6.2%	Flow>95cfs	160.0	-6.3%	Flow>95cfs	4116.8	47.2	N/A
4/12/2022	189.8	-3.6%	Flow>95cfs	170.8	6.4%	Flow>95cfs	4216.1	47.4	N/A
4/11/2022	196.8	0.6%	Flow>95cfs	160.5	-0.2%	Flow>95cfs	4246.3	48	N/A

TABLE 5. a) WY 2022 loss and salvage predictor data: Predicted weekly loss of winter-run Chinook salmon and steelhead at CVP and SWP facilities. b) Environmental details, current and forecast.

Week	28	29
a)	Model	
Steelhead median	17	0
Steelhead high	75	39
Winter-run Chinook median	0	0
Winter-run Chinook high	0	0
b)	Data	Forecast
Temperature (Mallard Island, C)	16.6	17.0
Precipitation (5-d running sum, inches)	0.07	0.07
Old + Middle River flows (cfs)	-437	-437
Sacramento River flow (Freeport, cfs)	7,135	7,135
DCC Gates	Open	Closed
San Joaquin River flow (Vernalis, cfs)	685	685
Export	1,280	1,280

TABLE 6. Preliminary survival ( $\Phi$ ) results for acoustically tagged salmonids (Chinook and steelhead). Individual studies denoted by rows with bold lines.

<b>Project</b>	<b>Group (n)</b>	<b>Release Date(s)</b>	<b>Release Location</b>	<b>Min. <math>\Phi</math> to Tower Bridge</b>	<b>Min. <math>\Phi</math> to Benicia Bridge (East Span)</b>	<b>Min. through-Delta <math>\Phi</math> (Sac to Benicia)</b>	<b>Notes</b>
Hatchery-origin Chinook salmon: Seasonal Survival Study	Week 1 (200)	12/15/2021 – 12/16/2021	RBDD	75.5% (SE = 3.0)	17.1% (SE = 2.6)	22.7% (SE = 3.4)	Fish detected at Old River and Benicia receivers
Hatchery-origin Chinook salmon: Seasonal Survival Study	Week 2 (200)	2/2/2022 – 2/3/2022	RBDD	5.5% (SE = 1.6)	0.5% (SE = 0.1)	9.1% (SE = 8.7)	Fish detected at Tower Bridge, below Georgiana, and Benicia receivers
Hatchery-origin Chinook salmon: Seasonal Survival Study	Week 3 (200)	2/23/2022 – 2/24/2022	RBDD	3.0% (SE = 1.2)	1.0% (SE = 0.7)	33.3% (SE = 19.2)	Fish detected at Tower Bridge and Georgiana receivers
Hatchery-origin Chinook salmon: Seasonal Survival Study	Week 4 (200)	3/17/2022 – 3/18/2022	RBDD	3.5% (SE = 1.3)	0.5% (SE = 0.5)	14.3% (SE = 13.2)	Fish detected at I-80 (3.5%) and Benicia (0.5%) receivers
Hatchery-origin Chinook salmon: Seasonal Survival Study	Week 5 (367)	4/7/2022 – 4/8/2022	RBDD	0%	0%	0%	Fish detected at Butte Bridge receiver (0.5%)

Project	Group (n)	Release Date(s)	Release Location	Min. $\Phi$ to Tower Bridge	Min. $\Phi$ to Benicia Bridge (East Span)	Min. through-Delta $\Phi$ (Sac to Benicia)	Notes
Hatchery-origin winter-run Chinook salmon	Week 1 (139)	2/9/2022	Caldwell Park, Redding	15.8% (SE = 3.1)	6.5% (SE = 2.1)	40.9% (SE = 10.5)	Fish detected at Tower Bridge, I80 Bridge (15.8%), and Benicia (6.5%) receivers
Hatchery-origin winter-run Chinook salmon	Week 2 (430)	3/2/2022	Caldwell Park, Redding	12.6% (SE = 1.6)	5.6% (SE = 1.1)	44.4% (SE = 6.8)	Fish detected at Tower Bridge, below Georgiana (4.9%), and Benicia (5.6%) receivers
Hatchery-origin Battle Creek winter-run Chinook salmon	Release 1 (312)	3/16/2022	North Fork Battle Creek, below ECD	1.0% (SE = 0.6)	0%	0%	Fish detected at Tower Bridge (0.6%) and I-80 (0.6%) receivers
Hatchery-origin Battle Creek winter-run Chinook salmon	Release 2 (600)	3/16/2022	North Fork Battle Creek, below ECD	0.7% (SE = 0.3)	0.2% (SE = 0.2)	25% (SE = 21.7)	Fish detected at Tower Bridge (0.7%) and I-80 (0.7%) receivers
Hatchery-origin Battle Creek winter-run Chinook salmon	Release 3 (288)	3/16/2022	North Fork Battle Creek, below ECD	1.0% (SE = 0.6)	0%	0%	Fish detected at Tower Bridge (1%) and I-80 (1%) receivers

Project	Group (n)	Release Date(s)	Release Location	Min. $\Phi$ to Tower Bridge	Min. $\Phi$ to Benicia Bridge (East Span)	Min. through-Delta $\Phi$ (Sac to Benicia)	Notes
6-year study San Joaquin River steelhead – March releases	Head of Old River (144)	3/15/2022	Head of Old River	Not Enough Detections Yet	6.3% (SE = 2.0)	NA	Fish detected at Clifton Court Radial Gates, CVP trash rack, and Benicia receivers
6-year study San Joaquin River steelhead – March releases	Durham Ferry (248)	3/15/2022	Durham Ferry	Not Enough Detections Yet	4.0% (SE = 1.2)	NA	Fish detected at Clifton Court Intake Canal, CVP trash rack, and Benicia receivers
6-year study San Joaquin River steelhead – March releases	Stockton (100)	3/15/2022	Stockton	Not Enough Detections Yet	12.1% (SE = 3.3)	NA	Fish detected at Old River Quimby Island and Benicia (6%) receivers
Hatchery-origin San Joaquin spring-run Chinook salmon	Fremont Ford (694)	3/30/2022	Freemont Ford	Not Enough Detections Yet	Not Enough Detections Yet	Not Enough Detections Yet	Not Enough Detections Yet
Hatchery-origin rice field reared fall-run Chinook salmon	Release 1 (315)	3/7/2022	Sutter Bypass	9.2% (SE = 1.6)	1% (SE = 0.5)	10.3% (SE = 5.7)	Fish detected at Below Georgiana and Benicia (1%) receivers
Hatchery-origin fall-run Chinook salmon paired release	Upstream (300)	4/5/2022	Battle Creek	Not Enough Detections Yet	Not Enough Detections Yet	Not Enough Detections Yet	Fish detected at Butte Bridge receiver (42%)

<b>Project</b>	<b>Group (n)</b>	<b>Release Date(s)</b>	<b>Release Location</b>	<b>Min. <math>\Phi</math> to Tower Bridge</b>	<b>Min. <math>\Phi</math> to Benicia Bridge (East Span)</b>	<b>Min. through-Delta <math>\Phi</math> (Sac to Benicia)</b>	<b>Notes</b>
Hatchery-origin fall-run Chinook salmon paired release	Downstream (300)	4/7/2022	Sac River, Butte City	Not Enough Detections Yet	Not Enough Detections Yet	Not Enough Detections Yet	Fish detected at Butte Bridge receiver (1%)

Table updated 4/11/2022. Additional information for all projects can be found online at

<https://oceanview.pfeg.noaa.gov/CalFishTrack/>



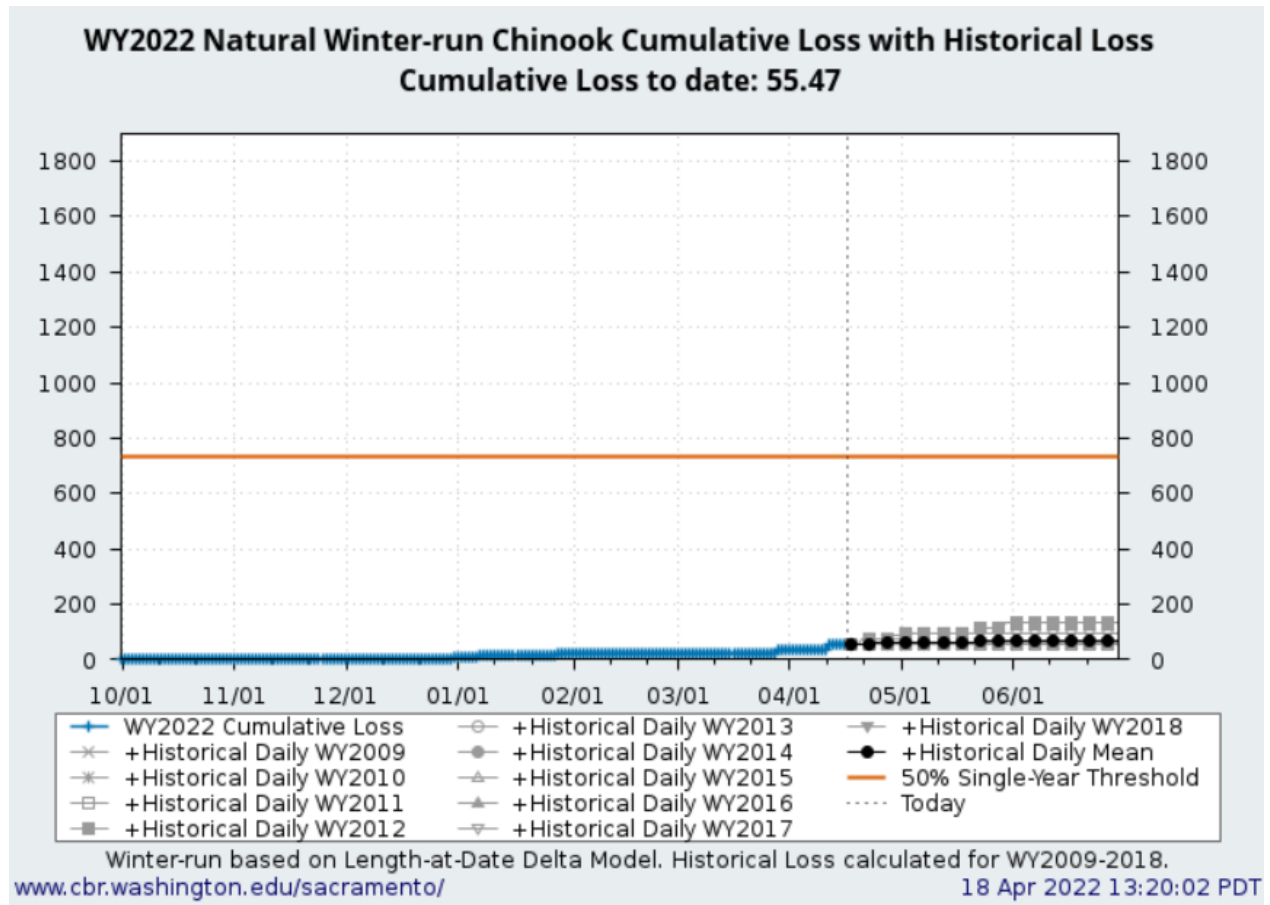


FIGURE 1. WY 2022 cumulative natural winter-run Chinook salmon loss (blue) and 2009 – 2018 historic cumulative loss (gray, different symbols). Historic daily mean plotted in black circles.

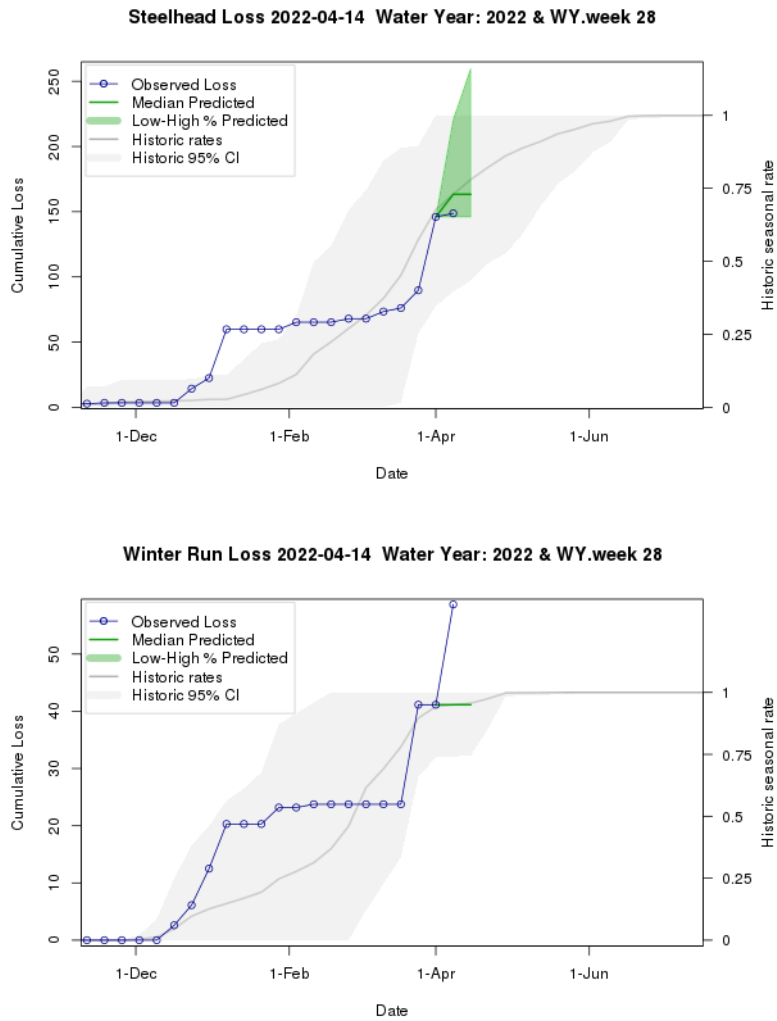


FIGURE 2. Predicted weekly loss of steelhead and winter-run Chinook salmon at the CVP and SWP facilities

## EVALUATION

1. **After January 1, are more than 5% of juveniles from one or more salmonid species present in the Delta?**

Greater than 5% of juvenile winter-run Chinook salmon, CCV steelhead, and young of year spring-run Chinook salmon are present in the Delta.

2. **Does the operational outlook's ranges impact fish movement and change the potential distribution of fish?**

Potential effects within the 7 days (near-term) in the operations outlook.

OMR flow is expected to remain at or more positive than -5,000 cfs this upcoming week.

Potential effects longer than the 7 days (longer-term) in the operations outlook.

See response above to (2) (i).

3. **What is the likelihood of increased loss exceeding the next annual loss threshold (50%, 75% or 90% of threshold) resulting in OMR management actions based on population distribution, abundance, and behavior of fish in the Delta?**

### Winter-run Chinook salmon

Total juvenile natural winter-run Chinook salmon (LAD) loss is 73.04 fish (as of 4/17/2022). Loss of juvenile winter-run Chinook salmon has occurred in the past week at the CVP and SWP fish salvage facilities. The agencies in the SaMT assessed the likelihood of exceeding the next annual loss threshold and believe that loss occurring in the next week is unlikely to lead to exceedance of the 50% single-year loss threshold set in the Proposed Action. SaMT anticipates potential loss occurring in the next week leading to exceedance of ITP COA 8.6.1 (winter run single year loss threshold) and ITP COA 8.6.3 (mid and late season natural winter-run daily loss threshold). ITP COA 8.6.3 threshold was exceeded on 4/12/2022 and 4/16/2022 this past week.

Total hatchery winter-run Chinook salmon loss is 6.71 fish (as of 4/17/2022). Loss of hatchery winter-run Chinook salmon has not occurred in the past week at the CVP and SWP fish salvage facilities. The agencies in the SaMT assessed the likelihood of exceeding the next annual loss threshold and believe that loss is unlikely to occur in the next week and is unlikely to lead to exceedance of the 50% loss threshold set in the Proposed Action.

### Spring-run Chinook salmon

Total juvenile spring-run Chinook salmon (LAD) loss is 48.08 fish (as of 4/17/2022). Loss of juvenile spring-run Chinook salmon has occurred in the past week at the CVP and SWP fish salvage facilities. The agencies in the SaMT assessed the likelihood of exceeding the next annual loss threshold and believes that loss occurring in the next week

is unlikely to lead to exceedance of the 50% single-year loss threshold set in the Proposed Action. SaMT does not anticipate loss occurring in the next week leading to exceedance of ITP COA 8.6.4 (daily spring run Chinook hatchery surrogate loss threshold).

#### Central Valley Steelhead

Total natural juvenile steelhead loss (December 1 through March 31) is 84.28 fish (as of 4/17/2022). Total natural juvenile steelhead loss (April 1 through June 15) is 72.0 fish (as of 4/17/2022). Loss of natural juvenile has occurred in the past week at the CVP and SWP fish salvage facilities. Total clipped steelhead loss is 449.48 fish (as of 4/17/2022). The agencies in the SaMT assessed the likelihood of exceeding the next annual loss threshold and believe that loss occurring in the next week is unlikely to lead to exceedance of the 50% single-year loss threshold set in the Proposed Action.

#### **4. If an annual loss threshold has been exceeded, do continued OMR restrictions benefit fish movement and survival based on real-time information?**

##### Winter-run Chinook salmon

The ITP COA 8.6.1 (winter run single year loss threshold) and ITP COA 8.6.3 (mid and late season natural winter-run daily loss threshold) have not been exceeded in WY 2022. The annual loss threshold set in the Proposed Action for winter-run Chinook salmon has not been exceeded in WY 2022.

##### Spring-run Chinook salmon

The ITP COA 8.6.4 (daily spring run Chinook hatchery surrogate loss threshold) has not been exceeded in WY 2022. The annual loss threshold set in the Proposed Action for spring-run Chinook salmon has not been exceeded in WY 2022.

##### Central Valley Steelhead

The annual loss threshold set in the Proposed Action for steelhead (December 1 – March 31) has not been exceeded in WY 2022.

#### **5. If OMR is more negative than -5,000 cfs are there changes in spawning, rearing, foraging, sheltering, or migration behavior beyond those anticipated to occur under OMR management at -5,000 cfs?**

OMR flows are not expected to be more negative than -5,000 cfs during the next week.

## **Biology Distribution and Evaluation of Green Sturgeon POPULATION STATUS**

### **Delta Life Stages:**

- Adults and Juveniles

### **Juvenile Abundance:**

- In 2021, 1037 larval green sturgeon and 5 juvenile green sturgeon were observed at the Red Bluff Diversion Dam during continuous fish monitoring using RSTs in the upper Sacramento River. 14 juveniles were captured and implanted with micro-acoustic tags during the month of October, and all were presumed to leave the upper Sacramento River during the unprecedented storm /run-off event that occurred on October 24, 2021 that resulted in flows at Bend Bridge of ~37,000 cfs.

## **DISTRIBUTION**

### **Current Distribution**

- Adults: Most abundant during spring spawning migration period of March through May, and post spawning out-migration periods May through June; October through January depending on first winter storm event resulting in significant Sacramento River flow increases. Adult presence year-round to a lesser extent mainly in San Pablo Bay. Recent sporadic occurrences of adult green sturgeon in the San Joaquin River system but spawning has not been documented. Unknown if spawning occurred historically in the San Joaquin River system. ARIS surveys confirmed adult sturgeon present in the Feather River.
- Juveniles: Age-1 through Age-3 juveniles present year-round and widely distributed. Juveniles tagged with acoustic tags in the main channel Sacramento River near Sherman Island detected in the Sacramento River as far upstream as the Cache Slough complex, in the San Joaquin River at the Antioch Bridge, in Threemile, Horseshoe Bend, and Montezuma Sloughs. Seasonal abundance at the primary sampling site (near Sherman Island) appears to be highest during summer in based on capture and telemetry data. Residence time at the primary sampling site for individual fish ranges from one day to over one year but telemetry data show outmigration from the primary sampling site to the Pacific Ocean ranges from 27 to 552 days. Recent capture data shows diurnal depth preference in the main channel of the Sacramento River. No recent documentation of shallow water habitat presence or foraging but likely. The remains of a juvenile/young adult green sturgeon were collected at CVP on 1/6/22; however, this does not count towards green sturgeon salvage totals.

### **Historical Trends**

- Juvenile and adult green sturgeon are historically present in the San Joaquin and Sacramento rivers and Delta

### Forecasted Distribution within Central Valley and Delta regions

- Juvenile and adult green sturgeon are present in the San Joaquin and Sacramento rivers and Delta during the next week.

### EVALUATION

#### 1. Is there likely to be salvage that may exceed the annual loss limit?

Green sturgeon salvage is 0 fish (as of 4/17/2022). The agencies in the SaMT assessed the likelihood of salvage occurring in the next week is unlikely to occur.

### Biology, Distribution, and Evaluation of Delta Smelt

#### POPULATION STATUS

##### Delta Smelt Life Stages:

Larvae and Adults

##### Brood Year 2021:

##### Abundance estimate:

The Delta Smelt All Strata abundance estimate was 2,015,772 for data collected between 4/4/2022-4/8/2022. The most recent detection of Delta Smelt was on 4/13/2022 (2 larvae EDSM) caught in the Lower Sacramento stratum.

##### Biological Conditions:

Adult Delta Smelt are present in the Sacramento Deep Water Ship Channel, Lower Sacramento and Suisun Marsh based on the survey detections with the previous two weeks. Larval Delta Smelt have been detected in the lower San Joaquin River stratum (station 815, 902), Lower Sacramento (706) and the north Delta (stations 711, 716, 718, 719, 726, 724). Delta water temperatures have reached the range in which Delta Smelt spawning occurs and larvae have been observed (Damon et al 2016). The Smelt Monitoring Team discussed the most recent monitoring data (Table 4) and considered professional opinion on the historical trends in regional distribution.

### DISTRIBUTION

#### Current Distribution

- Real time detection data is currently limited to EDSM sampling, 20-mm, Chipps Island, Bay Study, LEPS, and SKT.
- Since there are only a few recent detections of larval Delta Smelt, the Smelt Monitoring Team's capacity to estimate where they are within the Delta is limited.
- The last Delta Smelt detection was on 4/13/2022 in Lower Sacramento Stratum.

- Larval sampling at the Skinner Fish Facility (SFF) and the Tracy Fish Collection Facility (TFCF) began on 2/7/2021.
- COA 8.5.2: No larval or juvenile delta Smelt have been salvaged at the SFF or TFCF as of 4/5/2022 (Table 7).

TABLE 7. Summary of recently reported detections of Delta Smelt by Region and Salvage Facilities between 4/12/2022 and 4/18/2022. Start and end dates reflect period of time between updates to SMT. Regions are those defined by EDSM sampling. Delta Smelt >58mm FL are considered adults. Subadult fish are considered by the SMT to be fish from the previous year's cohort based on size and timing of collection. Young of year are considered juveniles and larvae.

Life Stage	North	South	West	Far West	Salvage
Adult	0	0	0	0	0
Subadult	0	0	0	0	0
Larvae/Juvenile	2	1	2	2	0

Table 8. Summary of recent Delta Smelt detections reported since last assessment and the total detections for the current water year. Notes reflect latest information on reported detections or completion of survey for the water year and include both larval and adult detections. Total Fish counts do not distinguish between hatchery origin and wild Delta Smelt. Table may include preliminary data that may not have received full QA/QC, but any corrections will be made the following week.

Sampling Method	Frequency	New Detections	WY2022	Notes
<a href="#">EDSM</a>	Weekly	4	61	Phase 2 Ongoing
SKT	Monthly	2	18	Ongoing SKT #5 starts 5/9/2022
<a href="#">SLS</a>	Biweekly	0	1	Complete
<a href="#">20-mm</a>	Biweekly	1	30	Survey 1: Processing Survey 2: Processing Survey 3: 4/18/2022
Summer Townet	Biweekly	0	0	Complete
<a href="#">Bay Study</a>	Monthly	0	1	Ongoing
<a href="#">FMWT</a>	Monthly	0	0	Complete
Chippis Island Trawl	Weekly	0	2	Ongoing

Sampling Method	Frequency	New Detections	WY2022	Notes
FCCL Brood Stock Collections	Weekly	0	0	Ended
LEPS	As available	0	0	Ongoing (20mm gear)
TFCF	Daily	0	1	Ongoing
FRP	Daily	2	3	Ongoing
Total	N/A	N/A	117	Sum of all Delta Smelt observed during the OMR Management Season

### Cultured Delta Smelt Experimental Releases

- On 12/14/2021-12/15/2021, the Experimental Release Technical Team trucked approximately ~12800 brood year 2021 Delta Smelt from the FCCL to Sacramento River at Rio Vista for release into the Delta. This release will include ~89% Adipose fin clipped individuals and ~11% Visible Implant Elastomer (VIE) tagged individuals.
- On 01/11/2022-01/12/2022, the Experimental Release Technical Team will truck approximately ~12,800 brood year 2021 Delta Smelt from the FCCL to Sacramento River at Rio Vista for release into the Delta. This release will include ~97% adipose fin clipped individuals and ~3% Visible Implant Elastomer tagged individuals.
- On 2/3/2022, the Experimental Release Technical Team trucked approximately ~6,400 brood year 2021 Delta Smelt from the FCCL to the Sacramento Deepwater Ship Channel for release into the Delta. This release will include ~56% adipose fin clipped individuals and ~44% Visible Implant Elastomer (VIE) tagged individuals.
- On 2/9/2022 – 2/10/2022, the Experimental Release Technical Team trucked approximately ~12,800 brood year 2021 Delta Smelt from the FCCL to the Suisun Marsh for release into Montezuma Slough at Belden’s Landing. This release will include ~99.5% adipose fin clipped individuals and ~0.5% Visible Implant Elastomer (VIE) tagged individuals.
- On 02/16/2022-02/17/2022, the Experimental Release Technical Team will truck approximately ~10933 brood year 2021 Delta Smelt from the FCCL to Sacramento Deepwater Ship Channel near channel marker 53 for release into the Delta. This release will include ~100% Adipose fin clipped individuals and ~0% Visible Implant Elastomer tagged individuals.
- Genetic analysis was completed on the two potentially wild Delta Smelt and they were determined to be of hatchery origin with poor quality fin clips. A third smelt



collect by the FCCL was identified as a hybrid and additional analysis is being run to determine parentage.

The unmarked DSM caught by EDSM on 1/5/2022, in the Lower Sacramento River stratum did not assign to a known pair cross of cultured DSM by the GVL, so will be considered as being of wild origin.

Table 9. Weekly summary of the origin of Delta Smelt. These identifications are considered tentative and additional genetic testing will confirm the identity of individuals. Individuals with no tags are provided alive to the FCCL as potential additions to the FCCL Broodstock. \*One of the larval fish collected by FRP was reported in the assessment on 4/12/2022 with incomplete data.

Date	Survey	Stratum/Station	Total Caught	Ad. Clipped	VIE	No Tag
4/5/2022	EDSM	Suisun Bay	2	0	0	2
4/13/2022	EDSM	Lower Sacramento	2	0	0	2
4/5/2022	20 MM	South Delta #902	1	0	0	1
4/14/2022	SKT	Montezuma Slough #606	1	1	0	0
4/13/2022	SKT	Sacramento Deep Water Ship Channel # 719	1	1	0	0
4/5/2022	FRP	Lower Yolo Ranch	2*	0	0	2
4/6/2022	FRP	Lower Yolo Ranch	1	0	0	1

### Historical Trends

- Wild Delta Smelt detections in the Sacramento Deep Water Ship Channel indicate presence upstream of the confluence, but the fish may be freshwater residents and not representative of the migratory life history patterns in Delta Smelt (Hobbs 2019).
- Historically, the highest peak in salvage is in May and the second highest is in June (Grimaldo et al 2009; figure 5).

### Forecasted Distribution within Central Valley and Delta regions

- Predicting the distribution of larval Delta Smelt is currently difficult because detection data is limited to a few individuals and historic patterns may not be representative of the low population levels.

- The SMT uses turbidity as a surrogate for Delta Smelt presence and in making assessments of the likelihood of entrainment for larval Delta Smelt after spawning begins.
- The potential of experimentally released Delta Smelt to distribute from their release site is unknown at this time and SMT cannot predict their distribution beyond the original release site and subsequent recaptures.

**ABIOTIC CONDITIONS**

**Turbidity**

- As of 4/19/2022 turbidity continues to be less than 12 FNU at Old River at Bacon Island (OBI) (See attachment B).
- Integrated Early Winter Pulse Protection ended on 1/2/2021.
- Precipitation is expected in the next seven days.
- Three Station Daily Average water temperature on 4/18/2022 was 16.69° C. This temperature is within the range of Delta Smelt spawning; 9-18 ° C (Damon et al 2016).

TABLE 10. Relevant Environmental Factors to the current management actions for Delta Smelt.

Date Reported	OBI Daily Turbidity (FNU)
4/18/2022	6.88

**X2 Conditions**

- X2 is estimated to be at 87 km.
- When X2 is above 81 km, the SMT uses the X2\_EC\_Graph.xlsx tool to estimate the position of X2 for both the Sacramento and San Joaquin Rivers and assumes the average of the two is representative of an approximate X2 position.

**Other Environmental Conditions**

- The Fish and Water Operation Outlook OMR Index values are expected to range between -1,000 to -1,550 cfs from 4/19/2022 to 4/25/2022.
- Real time tracking of environmental conditions, relevant thresholds and Delta Smelt catch data are updated daily at:  
[http://www.cbr.washington.edu/sacramento/workgroups/delta\\_smelt.html](http://www.cbr.washington.edu/sacramento/workgroups/delta_smelt.html)

## EVALUATION

**1. Between December 1 and January 31, has any first flush condition been exceeded?**

The running 3-day average flows and running 3-day average turbidity at Freeport exceeded the triggers for Integrated Early Winter Pulse Protection on 12/17/2021 (running 3-day averages: 27,152 cfs and 67 FNU). The CVP and SWP reduced exports from 12/20/2021 until 1/2/2022.

**2. Do DSM have a high risk of migration and dispersal into areas at high risk of future entrainment? (December 1- January 31)**

Based on recent detection data of experimentally released fish, Delta Smelt are unlikely to be prevalent in the South Delta. Delta Smelt are expected to have made their migration in response to first flush and temperatures are conducive to spawning. Delta Smelt are unlikely to move into the south and central delta since turbidity remains low.

**3. Has a spent female been collected?**

No spent female has been caught by SKT as of 4/19/2022. Two ripe females were observed in SKT 3. Two prespawm males were observed by SKT 4.

**4. If OMR of -2000 cfs does not reduce OBI turbidity below 12NTU/FNU, what OMR target is deemed protective between -2000 and -5000 cfs?**

OBI turbidity is currently below 12 FNU. Turbidity may change in response to precipitation the south delta.

**5. If OBI is 12 NTU/FNU, what do other station locations show?**

OBI turbidity is currently below 12 FNU. The daily average turbidities on 4/18/2022 at Prisoners Point (4.30 NTU), Holland Cut (6.71 FNU) and Victoria Canal (3.06 NTU), but may change due to precipitation over the next seven days.

**6. If OBI is 12 NTU/FNU, is a turbidity bridge avoidance action not warranted? What is the supporting information?**

The turbidity at OBI is below 12 FNU, and a turbidity bridge avoidance action ended on April 1<sup>st</sup>.

**7. After March 15 and if QWEST is negative, are larval or juvenile DSM within the entrainment zone of the CVP and SWP pumps based on surveys?**

As of 4/19/2022, QWEST has is expected to be positive and is expected to remain positive next seven-day period. A larval Delta Smelt have been observed in the OMR corridor as of 4/19/2022. Delta Smelt observed at station 902 have an increased likelihood of entrainment.

**8. Based on real-time spatial distribution of Delta Smelt and currently available turbidity information, should OMR be managed to no more negative than -3,500?**

Delta Smelt are present in the lower San Joaquin River and OMR Corridor based on recent detection data. Turbidity in the South Delta remains low across most stations (See Attachment B) but may increase with precipitation in the next seven days. The OMR index range is between -1,000 to -1,550 cfs for the next seven days. Delta Smelt observed at station 902 have an increased likelihood of entrainment.

**9. What do hydrodynamic models, informed by EDSM or other relevant data, suggest the estimated percentage of larval and juvenile DSM that could be entrained may be?**

There was a recent detection of larval Delta Smelt in the lower San Joaquin River and the OMR Corridor (station 815 and 902). Delta Smelt detections are limited to downstream locations in the San Joaquin and PTM results of nearby stations from 3/29/2022 along with the OMR index over the next seven days support the likelihood of entraining larval Delta Smelt remains low. Delta Smelt observed at station 902 have an increased likelihood of entrainment.

#### **DELTA SMELT REFERENCES**

- Damon, L. J., S. B. Slater, R. D. Baxter, and R. W. Fujimura. 2016. Fecundity and reproductive potential of wild female Delta smelt in the upper San Francisco Estuary, California. *California Fish and Game* 102(4):188–210.
- Hobbs, J. A., Lewis, L. S., Willmes, M., Denney, C., & Bush, E. (2019). Complex life histories discovered in a critically endangered fish. *Scientific Reports*, 9(1).  
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- Lenny F. Grimaldo, Ted Sommer, Nick Van Ark, Gardner Jones, Erika Holland, Peter B. Moyle, Bruce Herbold & Pete Smith (2009) Factors Affecting Fish Entrainment into Massive Water Diversions in a Tidal Freshwater Estuary: Can Fish Losses be Managed? *North American Journal of Fisheries Management*, 29:5, 1253-1270, DOI: 10.1577/M08-062.1
- Polansky, L., Newman, K.B., Nobriga, M.L. et al. Spatiotemporal Models of an Estuarine Fish Species to Identify Patterns and Factors Impacting Their Distribution and Abundance. *Estuaries and Coasts* 41, 572–581 (2018).  
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- Sommer, T., F. Mejia, M. Nobriga, and L. Grimaldo. 2011. The Spawning Migration of Delta Smelt in the Upper San Francisco Estuary. *San Francisco Estuary and Watershed Science* 9(2).

## **Attachment A**

### **Objective**

### **Background**

#### **DSM2 model results: summary tables**

#### **DSM2 model results: figures**

#### **DSM2 model interpretation entrainment into Delta strata regions**

#### **DSM2 channel locations information**

### **Objective**

Weekly modeling efforts are conducted to examine the effects of varying OMR conditions on the behavior of salmonids present in the Delta in a one-week “look ahead” or outlook. Members of the Salmon Monitoring Team (SaMT) use DSM2 modeling results to help answer how changing pumping regimes translates to differences in flows and velocities modeled at various channel locations within the Delta and what impact modeled environmental parameters may have on rearing, foraging, migrating, and holding salmonids.

Each series of runs consists of up to three OMR conditions: minimum and maximum scenarios bounded by expected OMR index values for that week (Ops Outlook, Table 1) and a baseline which represents an anticipated operational value. Assumptions are made to best estimate future hydrologic characteristics. These inputs are more confident for the future one, two, and three-day timeframes; days four through six have lower confidence. Model scenarios hold hydrology inputs between runs constant and adjust Delta export pumping rates to compare between scenario OMR index values (unless otherwise noted). Although hydrologic ensembles could be used, a single value or deterministic projection is used for efficiency.

SaMT members use weekly DSM2 model results from a range of scenarios as part of a suite of tools to help assess distribution and changes to behavior of salmonids. At each channel location over a six-day action period, environmental parameters are examined: modeled flow and velocity general statistics (e.g., magnitude, range, percent positive), differences in modeled flow and velocity values compared with the baseline scenario, etc. That information, in conjunction with channel location (e.g., close to the Delta pumping facilities, closer to areas with higher tidal influence, etc.) and other environmental considerations (e.g., tidal cycle, upcoming storms, etc.), is then interpreted from a biological perspective. The SaMT recognizes that interpretation of DSM2 model run results with respect to juvenile salmonids (non-neutrally buoyant particles) involves making some assumptions. SaMT explores the possible effects to salmonids of changing OMR index scenarios, assuming each of those potential operations could be that week’s controlling factor.

## Background

Category	Notes
Process	N/A
Weekly process	<ul style="list-style-type: none"> <li>• DSM2 model runs use a historic and forecasted hydrological input dataset with no assumptions provided by DWR Thursdays and updated by Reclamation Mondays.</li> <li>• Input File updated Monday after initial distribution from DWR for removal of forecasted in lieu of historic input.</li> <li>• Reclamation provides scenarios based on expected OMR index values for the upcoming week.</li> <li>• DSM2 model runs produced Monday and distributed to SaMT members.</li> </ul>
Hydraulic footprint information	N/A
Updated	4/18/2022 (baseline and scenarios)
DSM2 modeling results range	4/18/2022 – 4/24/2022
OMR index value scenarios	N/A
Baseline	-1,025 cfs
Scenario 1	N/A
Scenario 2	N/A
Changes between scenarios	N/A
Hydrology	No (see special considerations section below)
Delta Exports	Yes
Common assumptions	N/A
DSM2 run results based on the following assumptions	<ul style="list-style-type: none"> <li>• CCFB Gates are operating to Priority 1 through the end of the forecast period.</li> <li>• The Delta Cross Channel gates were closed on November 30 and will remain closed through the end of the forecast period.</li> <li>• Suisun Marsh salinity control flashboards are in, and 2 of the Suisun Marsh salinity control gates are in open position from March 8, and the remaining 1 gate is closed for maintenance.</li> <li>• See Figure A1a for Sacramento River flow at Freeport during the forecast period.</li> <li>• See Figure A1b for San Joaquin River flow at Vernalis during the forecast period.</li> <li>• Clifton Court Forebay and Tracy Pumping Plant pumping is shown for model runs in Figure A2.</li> </ul>

Category	Notes
Additional information	N/A
Considerations for current DSM2 model run	<ul style="list-style-type: none"> <li>• The Base case is constrained by D1641 TUCO (4/4) meeting the X2 requirement via outflow and the IOP for April and May under ITP section 8.17 (Vernalis 1:1) and bound by the minimum combined export of 1,500 cfs.</li> <li>• Likely to be in this “configuration” through May 2022.</li> </ul>
Caveats	<ul style="list-style-type: none"> <li>• Time-step: DSM2 generates results at 15-minute time-steps.</li> <li>• Visualizations of DSM2 model run results are aggregated over daily timesteps. Operations function on a more granular scale than daily time-step.</li> <li>• Salmonid behavior: DSM2 provides flow fields which salmonids may encounter but salmonids are not neutrally buoyant particles. Models which incorporate behavior from acoustic tagged salmonids are being developed for South Delta (ePTM, ecoPTM).</li> </ul>

DSM2 model results: figures

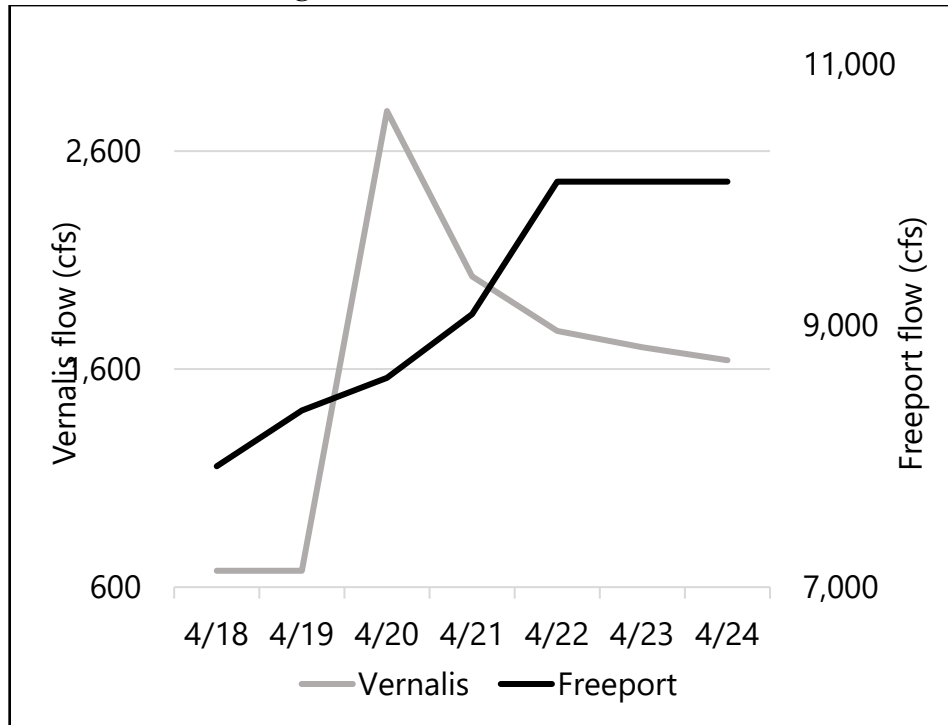


FIGURE A1. Daily forecasted Freeport and Vernalis flows (cfs).

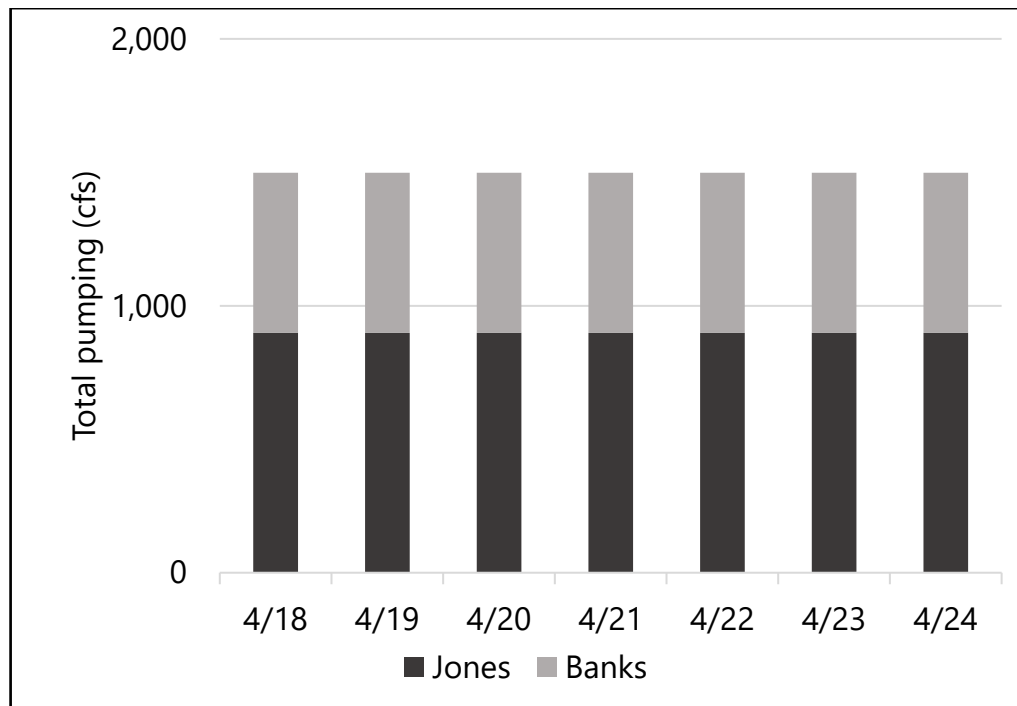


FIGURE A2. Daily forecasted pumping: Jones and Banks (cfs) for Baseline.



**DSM2 model results: summary tables**

Table A1. Summary of minimum, maximum, mean, and percent positive flows (cfs) and velocities (ft/s) by DSM2 channel for OMR scenarios over a 6-day time period. For scenario values refer to “Hydraulic Footprint Information” in the conditions / assumptions section above.

Scenario (cfs)	DSM2 Channel	Flow Min.	Flow Max.	Flow Mean	Flow % Positive	Velocity Min.	Velocity Max.	Velocity Mean	Velocity % Positive
Baseline-1025	6	-823.29	3084.39	1719.21	96.73	-0.39	1.57	0.88	96.73
Baseline-1025	21	-7098.63	7283.5	754.51	54.23	-0.48	0.46	0.06	54.23
Baseline-1025	49	-152640.28	142235.92	2066.54	51.26	-1.95	1.87	0.05	51.26
Baseline-1025	81	-3917.34	2689.78	-773.35	47.4	-1	0.76	-0.2	47.4
Baseline-1025	94	-12443.6	10631.96	-207.85	51.26	-1.63	1.5	0.01	51.26
Baseline-1025	107	-5811.71	4371.4	-292.26	51.26	-1.57	1.24	-0.06	51.26
Baseline-1025	124	-18908.78	12520.11	-2169.33	45.17	-0.61	0.41	-0.06	45.17
Baseline-1025	148	-7581.21	6333.13	-246.56	51.26	-0.82	0.71	-0.01	51.26
Baseline-1025	160	-4645.16	3640.04	-29.55	52.6	-0.48	0.45	0.02	52.6
Baseline-1025	434	-159563.62	157899.45	4984.86	51.86	-1.81	1.86	0.09	51.86

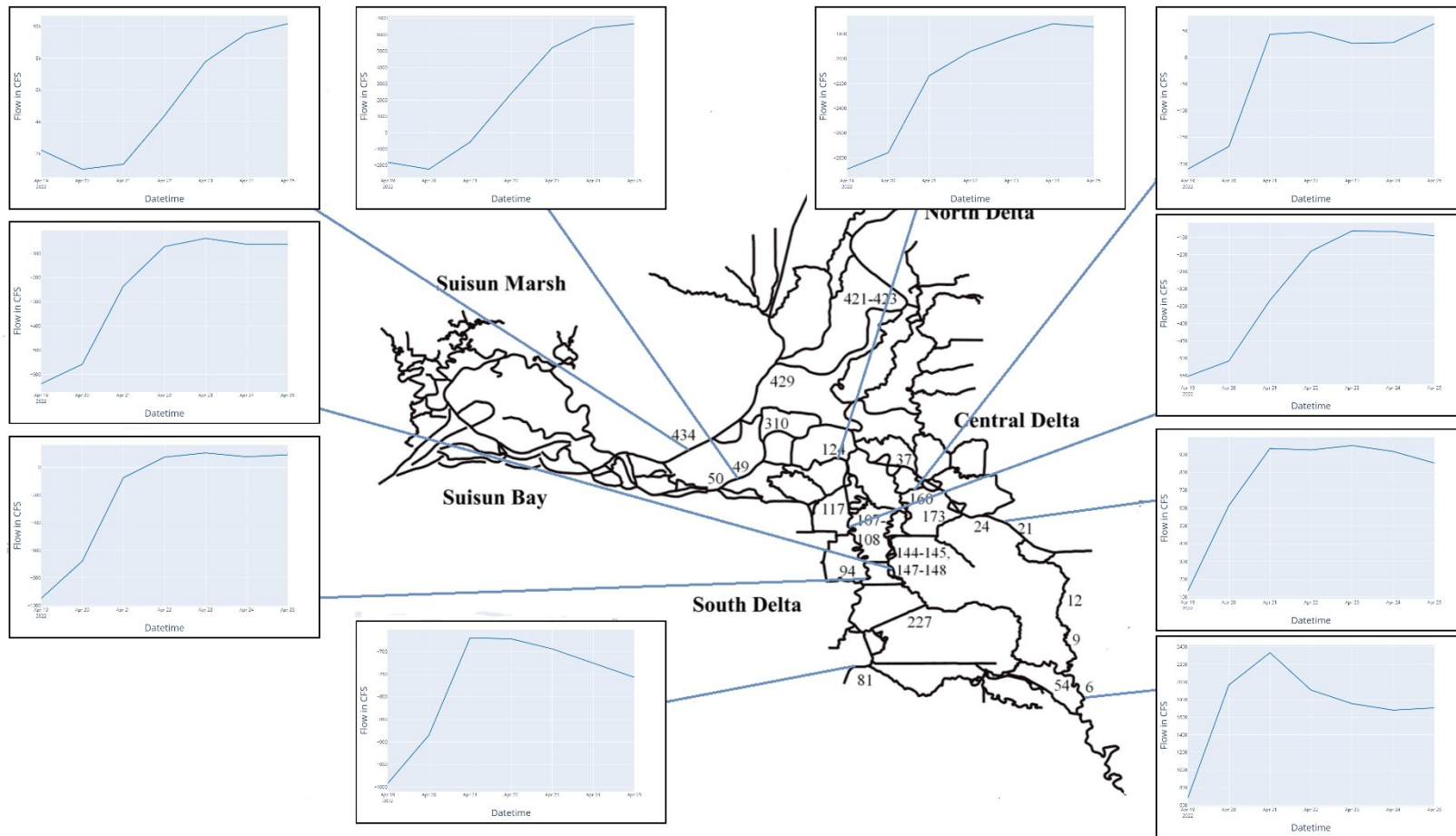


FIGURE A3: Spatial representation of DSM2 modeled flow by channel.

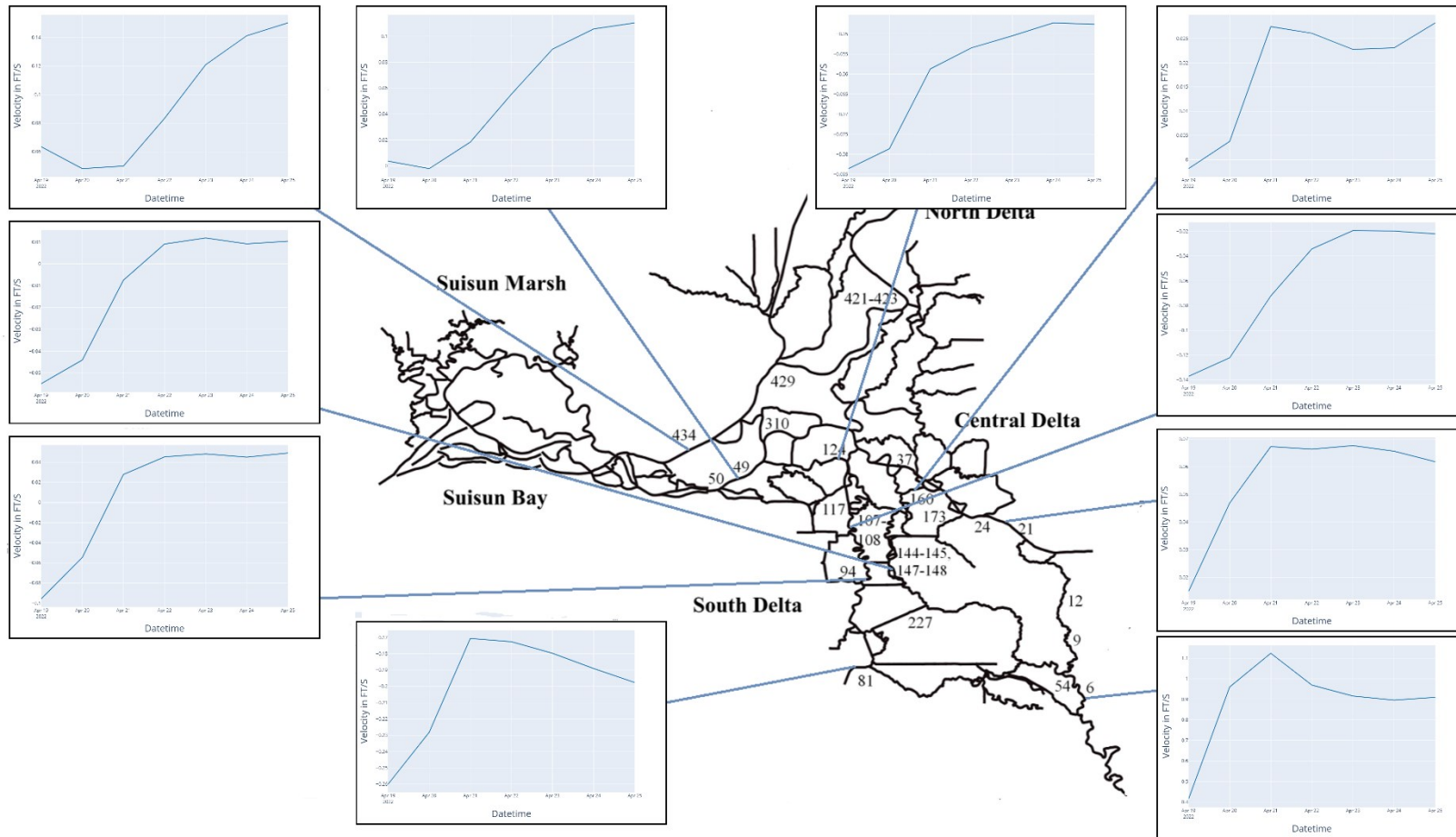


FIGURE A4: Spatial representation of DSM2 modeled velocity by channel.

## **DSM2 model interpretation entrainment in Delta strata regions, using modeled velocity results**

### North Delta into Interior and Central Delta

Channels 49 (San Joaquin River at Sherman Island) and 434 (Sacramento River at Sherman Island)

This week there was a single scenario modeled. There is no change to fish behavior with a lack of a 2<sup>nd</sup> (or 3<sup>rd</sup>) model to compare a baseline scenario to. Thus, the SaMT agreed discussing changes to fish behavior due to modeled conditions was not appropriate.

### San Joaquin River and Central Delta into South Delta

Channels 6 (San Joaquin River at Head of Old River) and 21 (San Joaquin River upstream of Turner Cut).

This week there was a single scenario modeled. There is no change to fish behavior with a lack of a 2<sup>nd</sup> (or 3<sup>rd</sup>) model to compare a baseline scenario to. Thus, the SaMT agreed discussing changes to fish behavior due to modeled conditions was not appropriate.

### South Delta into facilities

Channels 148 (Middle River) and 94 (Old River)

This week there was a single scenario modeled. There is no change to fish behavior with a lack of a 2<sup>nd</sup> (or 3<sup>rd</sup>) model to compare a baseline scenario to. Thus, the SaMT agreed discussing changes to fish behavior due to modeled conditions was not appropriate.

DSM2 channel locations information

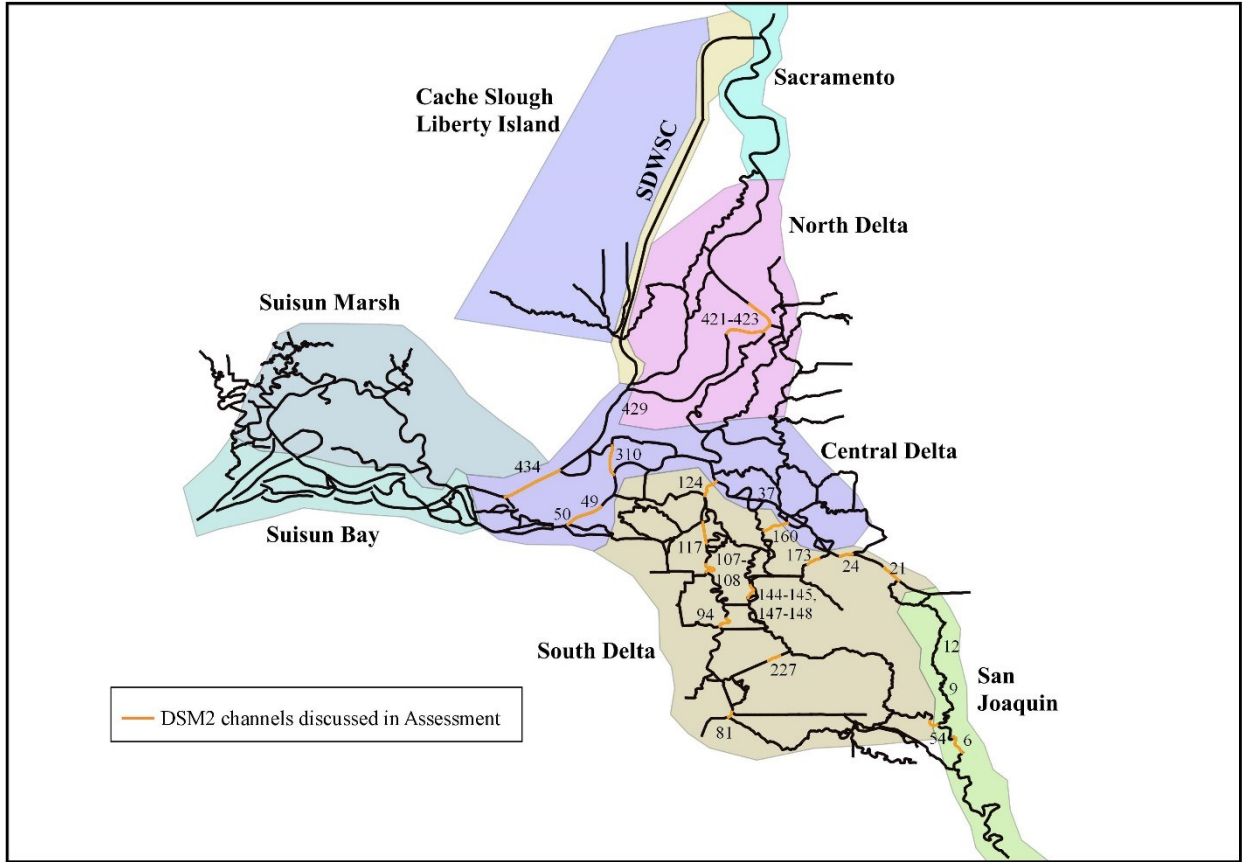


FIGURE A5. Highlighted DSM2 channels by Delta Strata.



FIGURE A6. Aerial imagery of several DSM2 channels discussed in Proposed Action Assessment. North Delta (channels 434 and 49, top panel), San Joaquin River and Central Delta (channels 6 and 21, bottom panel on right), and South Delta (channels 94 and 148, bottom panel on left). Scale for all channels held constant.

TABLE A2. Description of channel location, by Delta Strata region. Not all listed channels have model results presented in every weekly Proposed Action Assessment.

DSM2 Channel	Description
North Delta into Interior and Central Delta	N/A
CHAN049	San Joaquin River at Sherman Island
CHAN310	Three-Mile Slough
CHAN421	Sacramento River at Delta Cross Channel
CHAN422	Sacramento River at Delta Cross Channel
CHAN423	Sacramento River at Delta Cross Channel
CHAN434	Sacramento River at Sherman Island
San Joaquin River and Central Delta into South Delta	N/A
CHAN006	San Joaquin River at Head of Old River (HOR)
CHAN021	San Joaquin River downstream from confluence with Calaveras River
CHAN024	San Joaquin River upstream of Turner Cut
CHAN054	Old River at confluence with San Joaquin River (HOR)
CHAN107	Old River north of Rock Slough
CHAN117	Old River south of Franks Tract
CHAN124	Old River between Franks Tract and San Joaquin River
CHAN160	Columbia Cut
CHAN173	Turner Cut
South Delta into Facilities	N/A
CHAN148	Middle River
CHAN227	Victoria Canal
CHAN081	Grant Line Canal
CHAN094	Old River

## Attachment B: Delta Turbidity Report

Department of Water Resources  
Division of Operations and Maintenance  
SWP Water Operations Office

### Delta Turbidity Conditions Report

For conditions through: April 17, 2022

General Conditions:

**Inflows:**

Freeport	7862 cfs
Yolo Bypass	22 cfs
Vernalis	677 cfs
Cosumnes	782 cfs
Mokelumne	163 cfs
Calaveras	121 cfs

**Exports:**

Clifton Court	596 cfs
Jones	898 cfs

**Other:**

OMR (Index)	-1446 cfs
QWEST	1333 cfs
NDOI	6535 cfs



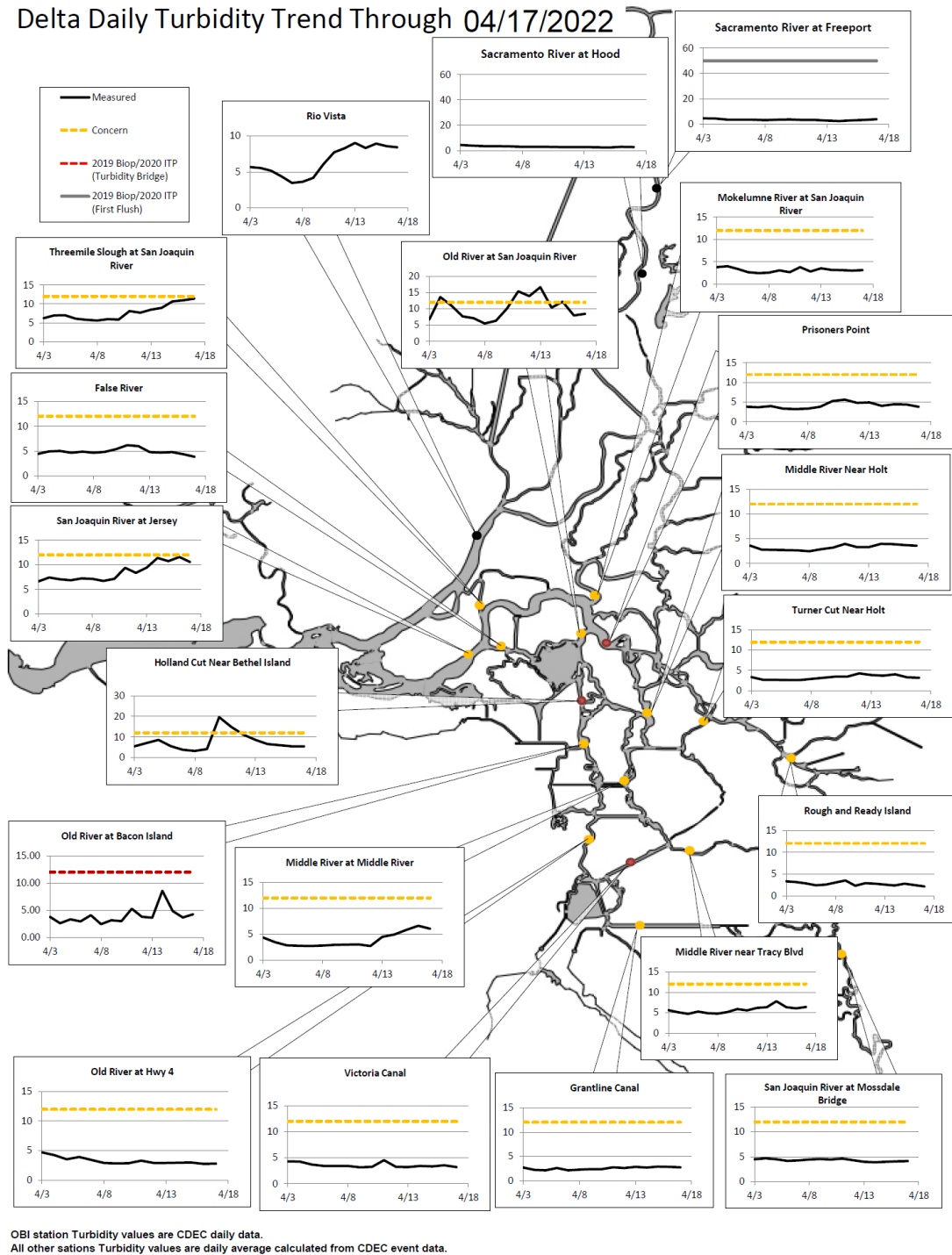


Figure 2. Delta Daily Turbidity Trends Through 04/17/2022

### Attachment C.

Genetic information from salvaged Chinook salmon results collected at Tracy Fish Collection Facility and Skinner through 1/12/2022. Underlined text in column headers (“CV ...”) represents aggregate of probability over four Chinook salmon runs for each sample.

Sample Date	FL*	JD**	ots28	Sex	Assignment	Pos Prob 1	Grp	Pos Prob2	CV fall	CV late-fall	CV spring	CV winter	Model	Facility
12/9/2021 14:00	233	162	late	M	Non-winter	1.000	Fall	1.000	1.000	0.000	0.000	0.000	Fall	CVP
12/19/2021 12:00	132	172	Late	F	Non-winter	1.000	Fall	1.000	1.000	0.000	0.000	0.000	Winter	CVP
12/24/2021 7:00	153	177	late	F	Non-winter	1.000	Fall	1.000	1.000	0.000	0.000	0.000	Late Fall	CVP
12/25/2021 12:00	158	178	late	M	Non-winter	1.000	Fall	1.000	1.000	0.000	0.000	0.000	Late Fall	CVP
12/25/2021 12:00	163	178	late	M	Non-winter	1.000	Fall	1.000	1.000	0.000	0.000	0.000	Late Fall	CVP
12/25/2021 12:00	130	178	late	M	Non-winter	1.000	Fall	1.000	1.000	0.000	0.000	0.000	Winter	CVP
12/27/2021 6:00	180	180	late	F	Non-winter	1.000	Fall	1.000	1.000	0.000	0.000	0.000	Late Fall	CVP
12/30/2021 14:00	185	183	late	F	Non-winter	1.000	Fall	1.000	1.000	0.000	0.000	0.000	Late Fall	SWP
12/31/2021 22:00	128	184	late	F	Non-winter	1.000	Fall	1.000	1.000	0.000	0.000	0.000	Winter	CVP
1/1/2022 6:00	174	185	late	M	Non-winter	1.000	Fall	1.000	1.000	0.000	0.000	0.000	Late Fall	CVP
1/7/2022 16:00	123	191	late	F	Non-winter	1.000	Fall	1.000	1.000	0.000	0.000	0.000	Winter	CVP
1/7/2022 22:00	130	191	late	F	Non-winter	1.000	Spring	0.549	0.451	0.000	0.549	0.000	Winter	CVP

*Proposed Action Assessment*  
 4/5/2022

Sample Date	FL*	JD**	ots28	Sex	Assignment	Pos Prob 1	Grp	Pos Prob2	CV fall	CV late-fall	CV spring	CV winter	Model	Facility
1/9/2022 18:00	135	193	late	F	Non-winter	1.000	Fall	0.932	0.932	0.000	0.068	0.000	Winter	CVP
1/12/2022 22:00	153	196	late	M	Non-winter	1.000	Fall	0.988	0.988	0.000	0.012	0.000	Winter	CVP

\* FL: Fork Length

\*\* JD: Julian Date