

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 March 29 – April 4

b) Winter-run Chinook Salmon summary

Loss of natural winter-run Chinook Salmon (by length at date, LAD) has not occurred in the past week at the fish salvage facilities (WY 2022 total loss = 20.56 fish, as of 3/27/2022). 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 occurred in the past week at the fish salvage facilities (WY 2022 total loss = 3.52 fish, as of 3/27/2022). 75-84% 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. 75-90% 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 = 73.4 fish, as of 3/27/2022). 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. 35-50% 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 3/27/2022). 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 South Delta. Detection data support Delta Smelt being present in the Sacramento Deep Water Ship Channel, Lower Sacramento, Cache Slough Liberty Island, Suisun Marsh, and Lower San Joaquin River. Delta Smelt adults and subadults are less likely to move into the south and central delta since turbidity remains low. Eight marked adult Delta Smelt have been collected since 3/22/2022. Nine larval Delta Smelt have been collected since 3/22/2022, including one larval Delta Smelt detected at station 815 in the lower San Joaquin River. A turbidity bridge avoidance action is not anticipated to be necessary in the next seven days. The expected OMR Index represents a higher likelihood of entrainment for larval Delta Smelt in the South Delta. The SMT recommends an OMR Index of $-1,250$ cfs on a seven-day average for the protection of larval Delta Smelt. Larvae are present the more negative OMR index range will increase the likelihood of entrainment. Water temperatures are within the range for Delta Smelt spawning.

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 3/25/2022 for the last 19 years of passage data is 99.8% (one SD of 0.2%). 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 45.9% juvenile spring-run sized Chinook salmon have been observed passing Red Bluff Diversion dam as of 3/27 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.

- 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.
- 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.

DISTRIBUTION

Winter-run Chinook Salmon

Current Distribution:

- On 3/29/2022, SaMT estimated 75-84% of juvenile winter-run Chinook salmon were present in the Delta and 15-20% 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 20.56 fish (as of 3/27/2022).
- Combined total hatchery winter-run Chinook salmon loss equals 3.52 fish (as of 3/27/2022).
- Fish have been steadily arriving since the beginning of October 2021.
- Winter-run Chinook Salmon have been observed in RST monitoring locations over the past week (Chippis Island). 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, 83.5% 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 is 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 now only a few years of historical loss would cause exceedance of the WY 2022 single-year loss threshold (WY 2011 and WY 2012). 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 don't believe precipitation events will 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 4 fish during this week (SacPAS last updated on 3/28/2022, 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 3/29/2022, SaMT estimated 75-90% 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, and Beach Seines, Tisdale, and Knights Landing).

Historical Trends

- Based on historical trends in salvage, 8.2% 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 3/29/2022 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 3/29/2022 SaMT estimated 35-50% of juvenile CCV steelhead were present in the Delta (Table 1).
- Combined total loss of hatchery steelhead equals 207.46 fish as of 3/27/2022.
- Combined total loss of natural steelhead between December 1 and March 31 equals 73.4 fish as of 3/27/2022.

Historical Trends

- Based on historical trends in salvage, 84.0% (December through March) 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 (Feather River).
- SaMT estimated that 35-50% 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 0 fish and a maximum loss of 30 fish during this week (SacPAS last updated on 3/28/2022, 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	1-5%	75-84%	15-20%
YOY spring-run Chinook salmon	10-25%	75-90%	0%
YOY hatchery winter-run Chinook salmon	67-79%	16-23%	5-10%
Natural origin steelhead	30-50%	35-50%	15-20%

Table 2. Historic migration and salvage patterns.

Date (3/27)	Red Bluff Diversion Dam	Tisdale RST	Knights Landing RST	Sac Trawl (Sherwood) Catch Index	Chipps Island Trawl Catch Index	Salvage
Chinook, Winter-run, Unclipped	99.7% (99.5%,99.9%) BY: 2012 - 2020	99.5% (99.0%,100.0%) BY: 2012 - 2020	99.4% (98.4%,100.4%) BY: 2013 - 2020	81.9% (65.4%,98.3%) BY: 2012 - 2020	50.0% (30.0%,70.1%) BY: 2012 - 2020	83.5% (71.9%,95.1%)
Chinook, Spring-run, Unclipped	45.9% (21.1%,70.8%) BY: 2012 - 2020	46.8% (19.7%,74.0%) BY: 2012 - 2020	42.8% (15.6%,70.0%) BY: 2013 - 2020	18.7% (5.5%,31.9%) BY: 2012 - 2020	0.7% (0.1%,1.3%) BY: 2012 - 2020	8.2% (-0.5%,17.0%)
Steelhead, Unclipped (December - March)	N/A	N/A	N/A	N/A	N/A	84.0% (70.2%,97.8%)

Table 3. STARS model output.

Date (3/28/2022)	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	0.29	0.45	0.25	N/A
Survival	N/A	16%	51%	38%	N/A

Date (3/28/2022)	DCC	Georgiana Slough	Sacramento River	Sutter and Steamboat	Interior Delta
Travel Time	N/A	18.0d	11.3d	11.7d	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	2%	4% Sutter 2% Steamboat	1%
Travel Time	N/A	N/A	6.7d	6.7d Sutter 6.5d Steamboat	10.2d

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
3/27/2022	283.7	-3.7%	Flow>95 cfs	246.5	-3.1%	Flow>95cfs	4189.2	N/A	N/A
3/26/2022	294.5	-1.5%	Flow>95 cfs	254.4	-3.0%	Flow>95cfs	4195.0	N/A	N/A
3/25/2022	299.1	-4.0%	Flow>95 cfs	262.3	-0.2%	Flow>95cfs	4223.4	49.4	N/A
3/24/2022	311.5	6.5%	Flow>95 cfs	262.8	6.7%	Flow>95cfs	4184.2	48.6	N/A
3/23/2022	292.5	19.8%	Flow>95 cfs	246.2	15.1%	Flow>95cfs	4239.7	47.8	N/A
3/22/2022	244.3	16.8%	Flow>95 cfs	214.0	4.7%	Flow>95cfs	4310.8	47	N/A
3/21/2022	209.2	-7.3%	Flow>95 cfs	204.4	-6.6%	Flow>95cfs	4384.8	46.5	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	25	26
a)	Model	N/A
Steelhead median	0	3
Steelhead high	30	39

Week	25	26
Winter-run Chinook median	0	0
Winter-run Chinook high	4	13
b)	Data	Forecast
Temperature (Mallard Island, C)	14.5	15.0
Precipitation (5-d running sum, inches)	0.03	0.03
Old + Middle River flows (cfs)	-2,191	-2,191
Sacramento River flow (Freeport, cfs)	8,821	8,821
DCC Gates	Open	Closed
San Joaquin River flow (Vernalis, cfs)	784	784
Export	1,408	1,408

Table 6. Preliminary survival (Φ) results for acoustically tagged salmonids (Chinook and steelhead). Individual studies denoted by rows with bold lines.

Project	Group (n)	Release Date(s)	Release Location	Min. Φ to Tower Bridge	Min. Φ to Benicia Bridge (East Span)	Min. through-Delta Φ (Sac to Benicia)	Notes
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 = 2.7)	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	5.0% (SE = 1.5)	0.5% (SE = 0.5)	10.0% (SE = 9.5)	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)	0.5% (SE = 0.5)	16.7% (SE = 15.2)	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	3.0% (SE = 1.2)	0%	0%	Fish detected at Butte Bridge (14.0%) and I-80 (3.0%) receivers
Hatchery-origin winter-run Chinook salmon	Week 1 (139)	2/9/2022	Caldwell Park, Redding	11.9% (SE = 1.6)	6.5% (SE = 2.1)	40.9% (SE = 10.5)	Fish detected at Tower Bridge, I80 Bridge (15.8%), and Benicia (6.5%) receivers

Project	Group (n)	Release Date(s)	Release Location	Min. Φ to Tower Bridge	Min. Φ to Benicia Bridge (East Span)	Min. through-Delta Φ (Sac to Benicia)	Notes
Hatchery-origin winter-run Chinook salmon	Week 2 (430)	3/2/2022	Caldwell Park, Redding	15.8% (SE = 3.1)	5.3% (SE = 1.1)	45.1% (SE = 7.0)	Fish detected at Tower Bridge, below Georgiana (4.9%), and Benicia (5.3%) receivers
Hatchery-origin Battle Creek winter-run Chinook salmon	Release 1 (312)	3/16/2022	North Fork Battle Creek, below ECD	Not Enough Detections Yet	Not Enough Detections Yet	Not Enough Detections Yet	Fish detected at Salt Creek (33%) receiver
Hatchery-origin Battle Creek winter-run Chinook salmon	Release 2 (600)	3/16/2022	North Fork Battle Creek, below ECD	Not Enough Detections Yet	Not Enough Detections Yet	Not Enough Detections Yet	Fish detected at Salt Creek (22%) receiver
Hatchery-origin Battle Creek winter-run Chinook salmon	Release 3 (288)	3/16/2022	North Fork Battle Creek, below ECD	Not Enough Detections Yet	Not Enough Detections Yet	Not Enough Detections Yet	Fish detected at Salt Creek (30%) receiver
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	0% NA)	N/A	Fish detected at Clifton Court Radial Gates and CVP trash rack receivers
6-year study San Joaquin River steelhead – March releases	Durham Ferry (248)	3/15/2022	Durham Ferry	Not Enough Detections Yet	0% NA)	N/A	Fish detected at Clifton Court Intake Canal and CVP trash rack receivers

Project	Group (n)	Release Date(s)	Release Location	Min. Φ to Tower Bridge	Min. Φ to Benicia Bridge (East Span)	Min. through-Delta Φ (Sac to Benicia)	Notes
6-year study San Joaquin River steelhead – March releases	Stockton (100)	3/15/2022	Stockton	Not Enough Detections Yet	2.0% (SE = 1.4)	N/A	Fish detected at Old River Quimby Island and Benicia (2%) receivers

Table updated 3/28/2022. Additional information for all projects can be found online at [CalFishTrack Central Valley Enhanced Acoustic Tagging Project](#).

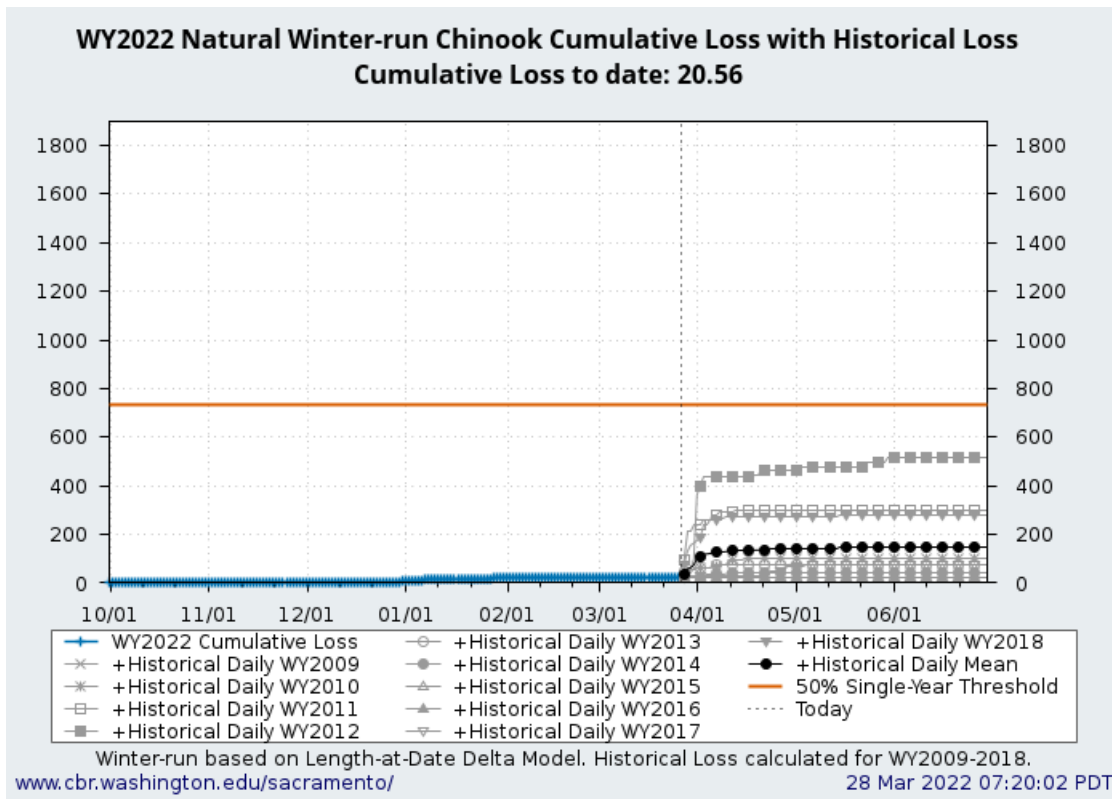


FIGURE 1. WY 2022 cumulative natural winter-run Chinook salmon loss (blue) and 2009 – 2018 historic cumulative loss (gray, different symbols). Historic daily mean plotted in black circles.

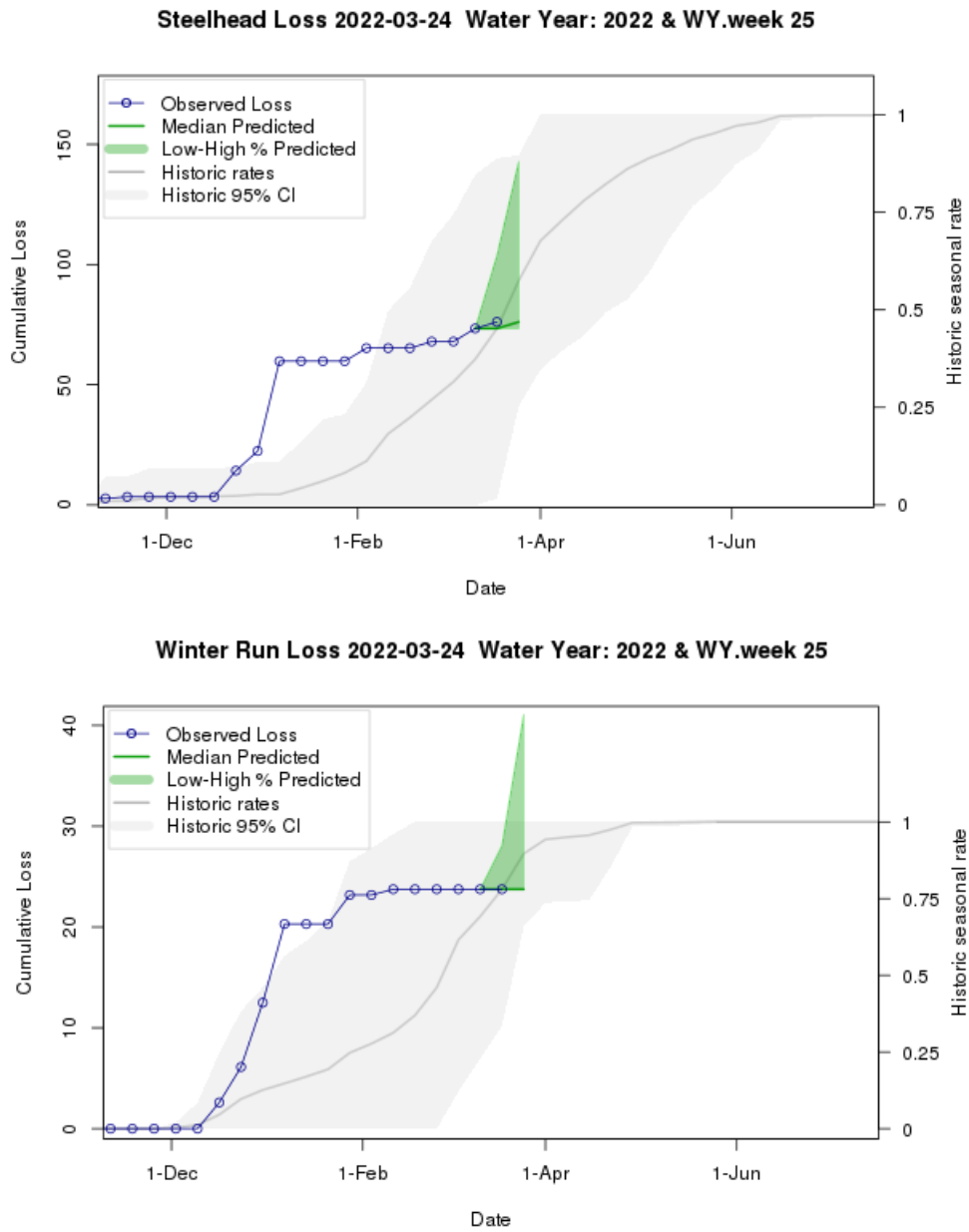


FIGURE 2. Predicted weekly loss of steelhead and winter-run Chinook salmon at the CVP and SWP facilities

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 20.56 fish (as of 3/27/2022). Loss of juvenile 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 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).

Total hatchery winter-run Chinook salmon loss is 3.52 fish (as of 3/27/2022). Loss of hatchery 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 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 0 fish (as of 3/27/2022). Loss of juvenile spring-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 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 73.4 fish (as of 3/27/2022). Loss of natural juvenile has occurred in the past week at the CVP and SWP fish salvage facilities. Total clipped steelhead loss is 207.46 fish (as of 3/27/2022). 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 3/27/2022). 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:

Larval, Subadults and Adults

Brood Year 2021:

Abundance estimate:

The adult Delta Smelt All Strata abundance estimate was 11,721 for data collected between 3/21/2022 - 3/25/2022. The most recent detection of Delta Smelt was on 3/23/2022 (6 individuals, marked, EDSM) caught in the Sacramento Deep Water Shipping Channel stratum.

Biological Conditions:

Adult Delta Smelt are present in the Sacramento Deep Water Ship Channel, Cache Slough Liberty Island 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) and the north Delta (stations 711, 716, 718, 719). Adult and subadult Delta Smelt are expected to have migrated in response to increases in turbidity and flow from “first flush” conditions (Sommer et al 2011). Delta water temperatures have reached the range in which Delta Smelt spawning may be occurring (Damon et al 2016). SKT 3 has observed two ripe females. As the season progresses the likelihood Delta Smelt are spawning increases despite larvae not being observed by monitoring surveys. 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, SKT, and SLS. Since there are only a few recent detections of 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 3/23/2022 in the Sacramento Deep Water Shipping Channel 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 3/29/22 (Table 7)

Table 7. Summary of recently reported detections of Delta Smelt by Region and Salvage Facilities between 3/22/2022 and 3/29/2022. Start and end dates reflect period of time between updates to SMT. Regional categories are determined from 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	7	0	0	1	0
Subadult	0	0	0	0	0
Larvae/Juvenile	8	1	0	0	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
EDSM	Weekly	7	55	Phase 1 began 11/29/2021 Phase 2 begins 4/4/2022

Sampling Method	Frequency	New Detections	WY2022	Notes
SKT	Monthly	0	16	Ongoing SKT #4 starts 4/11/2022
SLS	Biweekly	1	1	Survey 6: Processing Survey 6 is last survey of season
20-mm	Biweekly	8	8	20-mm survey 2 starts 4/4/22
Summer Towner	Biweekly	0	0	Complete
Bay Study	Monthly	0	1	Ongoing
FMWT	Monthly	0	0	Complete
Chippis Island Trawl	Weekly	0	2	Ongoing
FCCL Brood Stock Collections	Weekly	0	0	Ended
LEPS	As available	0	0	Ended
TFCF	Daily	0	1	Ongoing
Total	N/A	N/A	84	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.

Date	Survey	Stratum	Total Caught	Ad. Clipped	VIE	No Tag
3/17/2022	SKT 3	Suisun Marsh	8	7	1	0
3/16/2022	SKT 3	Lower Sacramento	1	1	0	0
3/16/2022	SKT 3	Sacramento Deepwater Ship Channel	2	2	0	0
3/17/2022	EDSM	Sacramento Deepwater Ship Channel	1	1	0	0
3/21/2022	EDSM	Cache Slough Liberty Island	1	1	0	0
3/21/2022	SLS	Sacramento Deep Water Ship Channel	5	0	0	5

Date	Survey	Stratum	Total Caught	Ad. Clipped	VIE	No Tag
3/22/2022	SLS	Lower San Joaquin River	1	0	0	1
3/23/2022	SLS	Sacramento Deepwater Ship Channel	1	0	0	1
3/23/2022	EDSM	Sacramento Deepwater Ship Channel	6	6	0	6
3/23/2022	EDSM	Cache Slough Liberty Island	1	1	0	0

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 adult wild 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.
- Given water temperatures are conducive to spawning, increasing turbidity and spring tides may influence the distribution of adults.
- 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 3/27/2022 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 3/28/2022 was 14.41° 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)
3/28/2022	5.44

X2 Conditions

- X2 is estimated to be at 82 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 -500 to -5,000 cfs from 3/29/2022 to 4/4/2022.
- Real time tracking of environmental conditions, relevant thresholds and Delta Smelt catch data are updated daily at: [SacPAS: Central Valley Prediction & Assessment of Salmon](#)

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 3/29/2022. Two ripe females were observed in SKT 3.

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 is expected to remain stable in 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 3/27/2022 at Prisoners Point (3.78 NTU), Holland Cut (5.2810.78 FNU) and Victoria Canal (3.71 NTU) and are expected to remain stable 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 is not expected to be warranted in the next seven days. South delta turbidity remains stable (See Attachment B).

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 3/29/2022, QWEST has been negative over the previous seven days, it is now positive and is expected to remain positive to near zero for the next seven-day period. One larval or juvenile Delta Smelt have been observed in the lower San Joaquin River as of 3/29/2022. PTM runs show that this larval Delta Smelt is within the entrainment zone of the CVP and SWP pumps.

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 based on recent detection data. Turbidity in the South Delta remains low across most stations (See Attachment B) and is expected to remain stable in the next seven days. The OMR index range is between -500 to -5,000 cfs for the next seven days. Based on PTM results, and detection of a larval Delta Smelt at station 815, the more negative OMR Index could lead to higher rates of entrainment. The SMT recommends a seven-day average OMR Index Value of -1,250 cfs will limit risk of entrainment to larval Delta Smelt.

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 (station 815). Due to this detection and PTM results of nearby stations the estimated percentage of larval and juvenile DSM that could be entrained may be as high 10% after three weeks at a seven-day average index of -2,500 cfs.. At a -1,250 cfs scenario it was 5%. The caveat to the PTM run is that it assumed there was 4 days of high OMR, not three, because the PTM run did not consider San Joaquin River IE.

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.
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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"> • DSM2 model runs use a historic and forecasted hydrological input dataset with no assumptions provided by DWR Thursdays and updated by Reclamation Mondays. • Input File updated Monday after initial distribution from DWR for removal of forecasted in lieu of historic input. • Reclamation provides scenarios based on expected OMR index values for the upcoming week. • DSM2 model runs produced Monday and distributed to SaMT members.
Hydraulic footprint information	N/A
Updated	3/28/2022 (baseline and scenarios)
DSM2 modeling results range	3/29/2022 – 4/4/2022
OMR index value scenarios	N/A
Baseline	-2,100 cfs
Scenario 1	-1,300 cfs (800 cfs more positive than baseline)
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"> • CCFB Gates are operating to Priority 1 through the end of the forecast period. • The Delta Cross Channel gates were closed on November 30 and will remain closed through the end of the forecast period. • 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. • See Figure A1a for Sacramento River flow at Freeport during the forecast period. • See Figure A1b for San Joaquin River flow at Vernalis during the forecast period. • Clifton Court Forebay and Tracy Pumping Plant pumping is shown for model runs in Figure A2.

Category	Notes
Additional information	N/A
Considerations for current DSM2 model run	<ul style="list-style-type: none"> • Baseline is constrained by D-1641 meeting the X2 requirement via outflow. • Scenario 1 is bound by minimum combined export of 1,500 cfs. • Delta inflows developed as “conservative,” no precipitation was assumed as part of runs after 0700 on 3/28/2022.
Caveats	<ul style="list-style-type: none"> • Time-step: DSM2 generates results at 15-minute time-steps. Visualizations of DSM2 model run results are aggregated over daily timesteps. Operations function on a more granular scale than daily time-step. <ul style="list-style-type: none"> ▪ 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).

DSM2 model results: figures

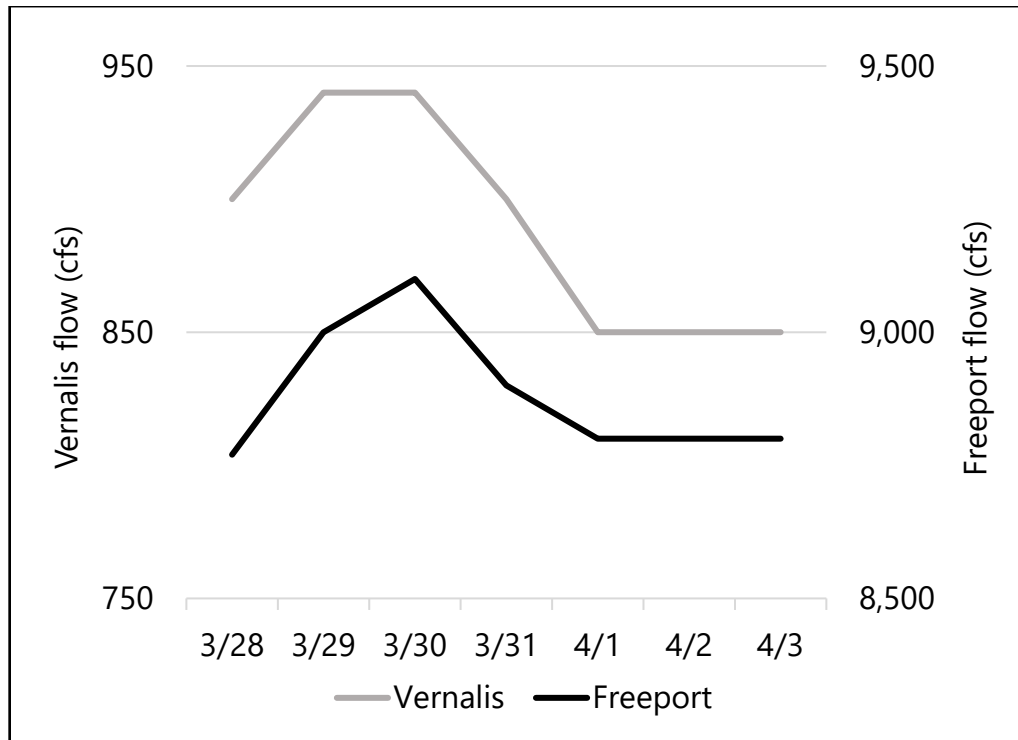


FIGURE A1. Daily forecasted Freeport and Vernalis flows (cfs).

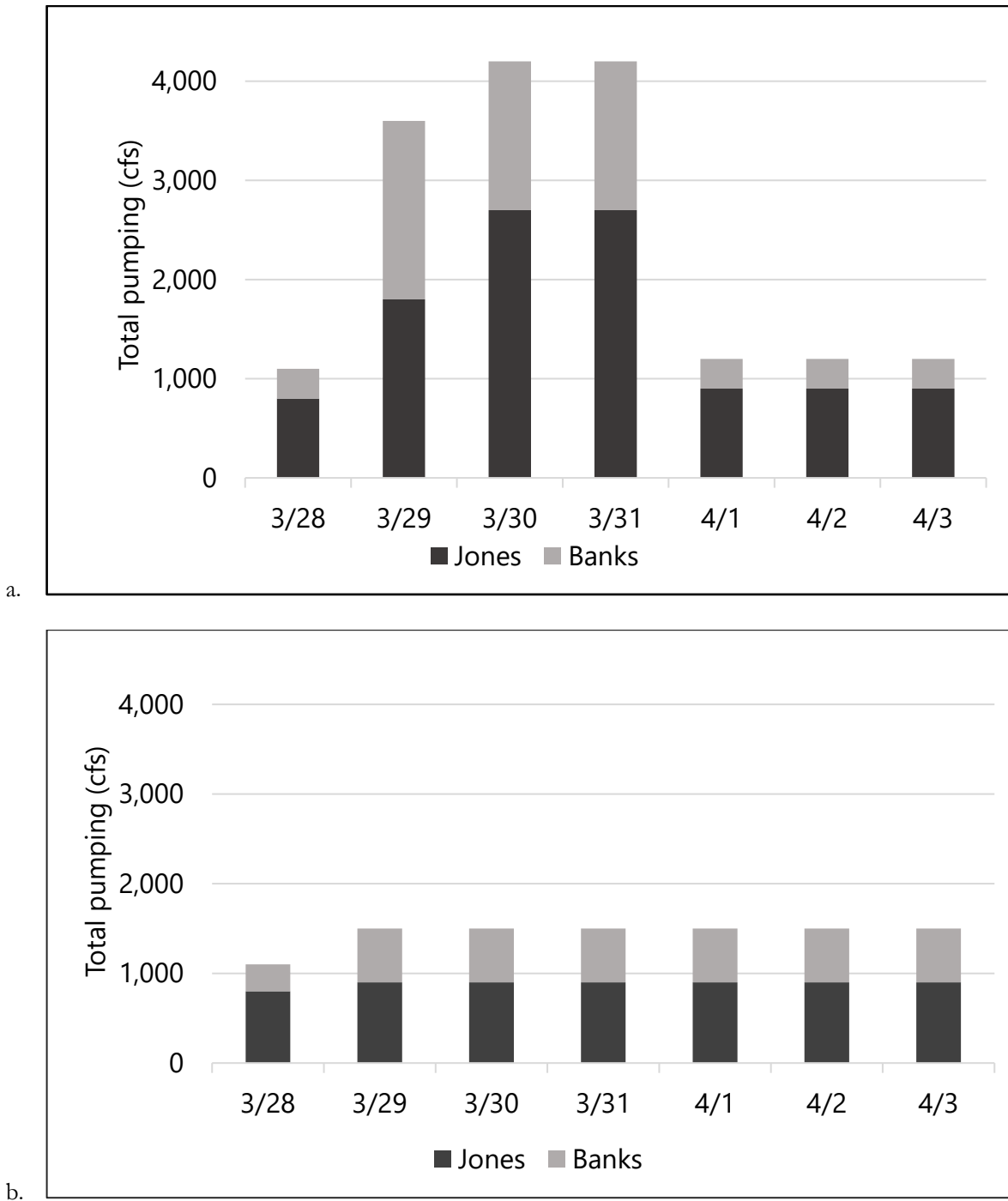


FIGURE A2a-b. Daily forecasted pumping: Jones and Banks (cfs) for (a) Baseline, and (b) Scenario 1.

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-2100	6	-503.9	1691.1	905.1	89	-0.2	1.1	0.5	89
OMR-1300	6	-504.3	1691.3	905.2	87	-0.2	1.0	0.5	87
Baseline-2100	21	-7950.4	6725.6	240.6	54	-0.5	0.4	0.0	54
OMR-1300	21	-7928.6	6756.4	266.0	54	-0.5	0.4	0.0	54
Baseline-2100	49	-158884.9	136839.7	1158.1	53	-2.0	1.8	0.0	53
OMR-1300	49	-157375.7	136818.6	1822.0	53	-2.0	1.8	0.1	53
Baseline-2100	81	-5407.4	3110.2	-1541.6	33	-1.5	0.9	-0.4	33
OMR-1300	81	-3821.5	2790.8	-908.4	46	-1.0	0.8	-0.2	46
Baseline-2100	94	-12655.0	9752.3	-1046.7	51	-1.7	1.4	-0.1	51
OMR-1300	94	-12218.3	9748.3	-599.8	52	-1.6	1.4	-0.1	52
Baseline-2100	107	-5794.0	4064.3	-525.0	51	-1.6	1.2	-0.1	51
OMR-1300	107	-5691.2	4062.6	-405.7	52	-1.6	1.2	-0.1	52
Baseline-2100	124	-19533.4	12260.5	-2709.6	44	-0.6	0.4	-0.1	44
OMR-1300	124	-19163.1	12257.1	-2490.6	46	-0.6	0.4	-0.1	46
Baseline-2100	148	-7405.6	5788.9	-632.8	51	-0.8	0.7	-0.1	51
OMR-1300	148	-7276.1	5786.4	-427.6	52	-0.8	0.7	0.0	52
Baseline-2100	160	-4813.4	3620.8	-181.8	52	-0.5	0.5	0.0	52
OMR-1300	160	-4695.2	3741.8	-88.0	52	-0.5	0.5	0.0	52
Baseline-2100	434	-167471.9	155143.6	5916.8	54	-1.9	1.8	0.1	54
OMR-1300	434	-167217.2	155128.4	6086.4	54	-1.9	1.8	0.1	54

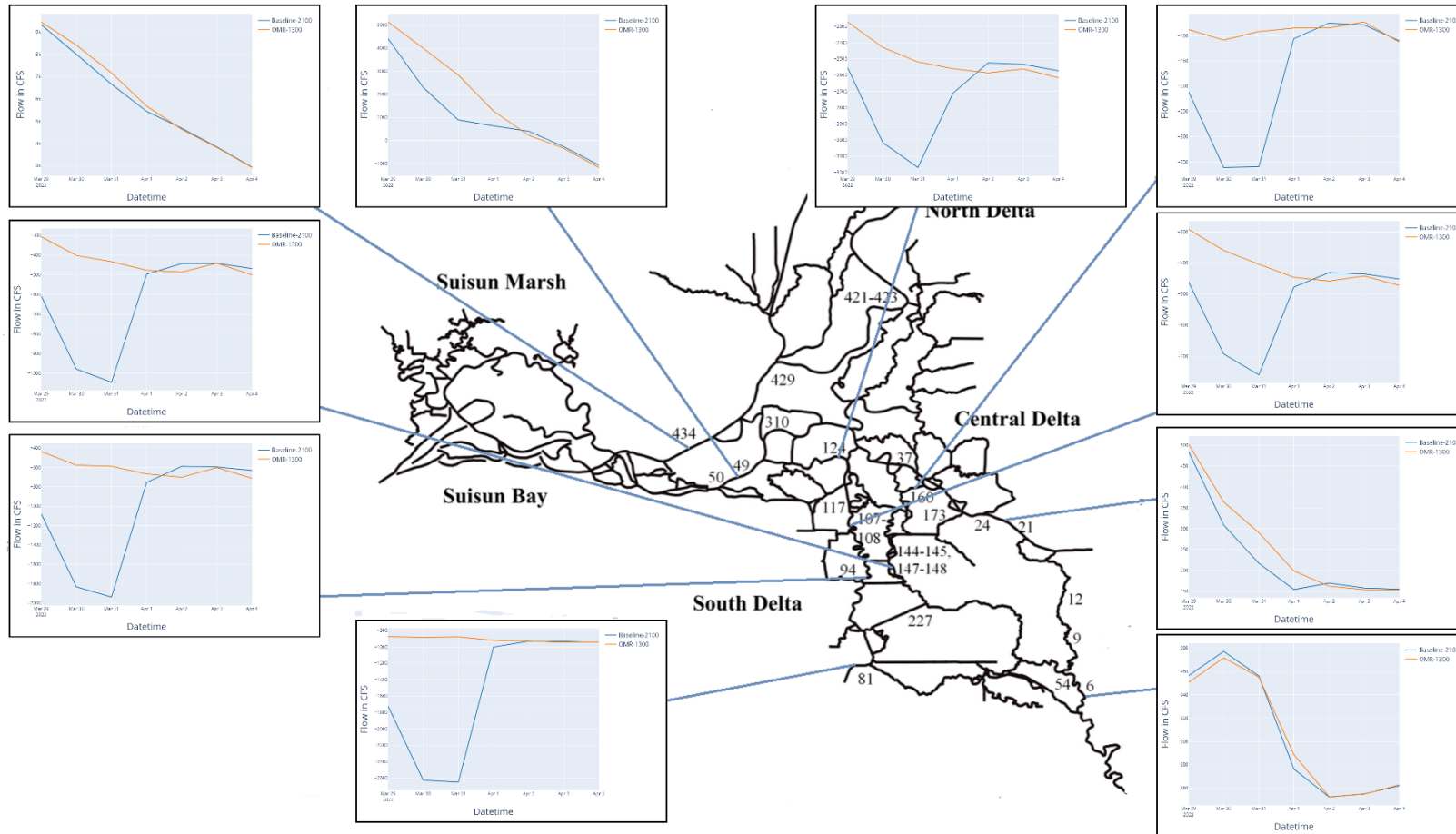


FIGURE A3: Spatial representation of DSM2 modeled flow by channel.

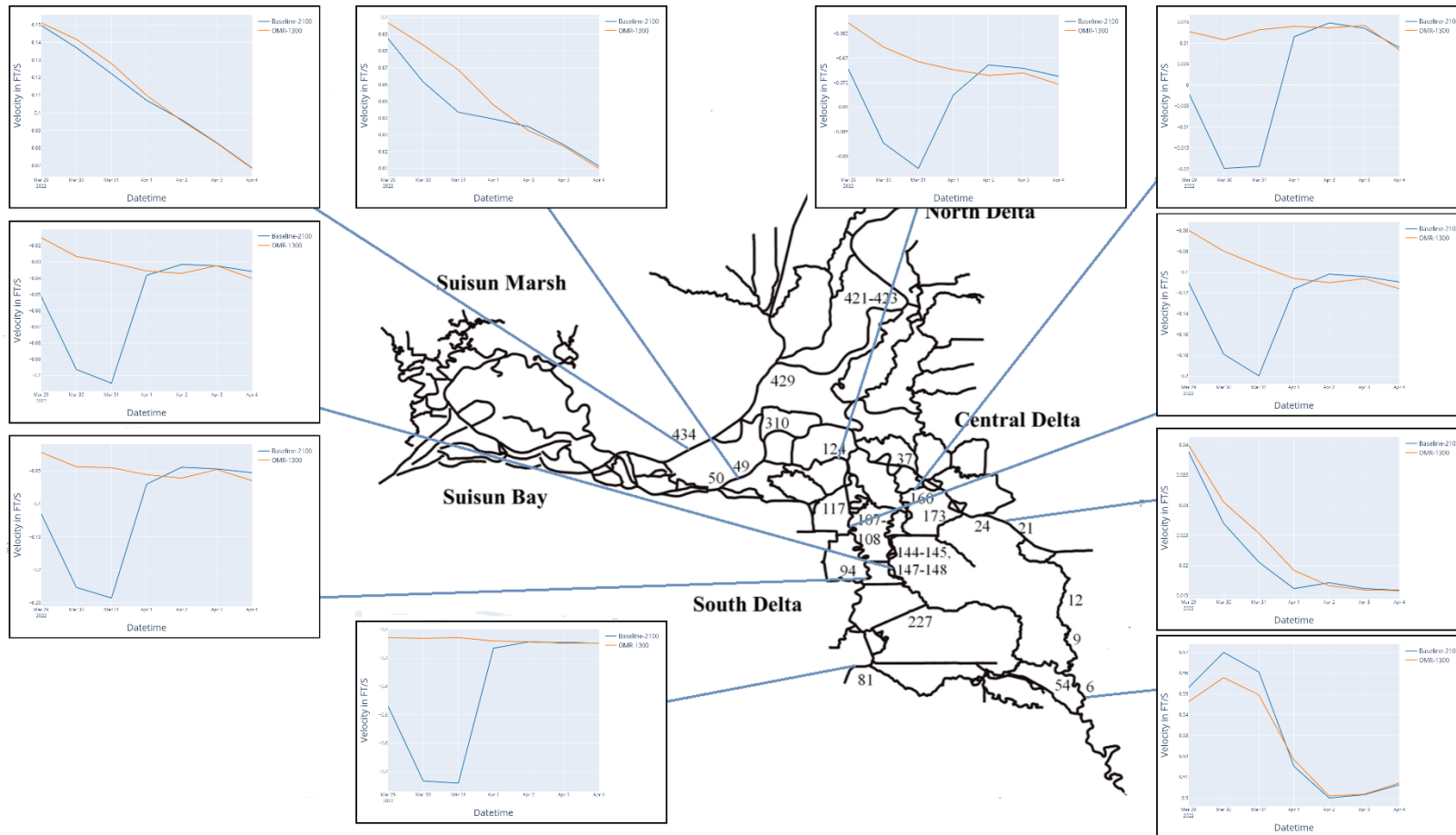


FIGURE A4: Spatial representation of DSM2 modeled velocity by channel.

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)

The largest daily difference in velocity for these two channels is .003 ft/second. The overall trend over the forecast period is a slight decrease in velocity. Fish that are moving will experience a slower travel rate over the forecast period. Changes to modeled velocity conditions would not likely be detected and it's unlikely that listed salmonids would experience changes to rearing, foraging, migrating and /or sheltering.

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).

The largest daily difference in velocity for these two channels is .001 ft/second. At Head of Old River the overall trend over the forecast period is a slight decrease in velocity followed by a constant velocity. For the San Joaquin River downstream from the confluence with Calaveras River the overall trend over the forecast period is a slight decrease in velocity. Overall, fish that are moving will experience a slower travel rate over the forecast period. Changes to modeled velocity conditions would not likely be detected and it's unlikely that listed salmonids would experience changes to rearing, foraging, migrating and /or sheltering.

South Delta into facilities

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

The largest daily difference in velocity for these two channels is .2 ft/second. Over the first three days of the forecast period there is a difference of modeled velocity between the baseline and Scenario 1 explained by the difference in daily forecasted pumping; however, in the second half of the forecast period there is no difference in modeled velocity between the modeled scenarios. In the second half of the forecast period changes to modeled velocity conditions would not likely be detected and it's unlikely that listed salmonids would experience changes to rearing, foraging, migrating and /or sheltering.

DSM2 channel locations information

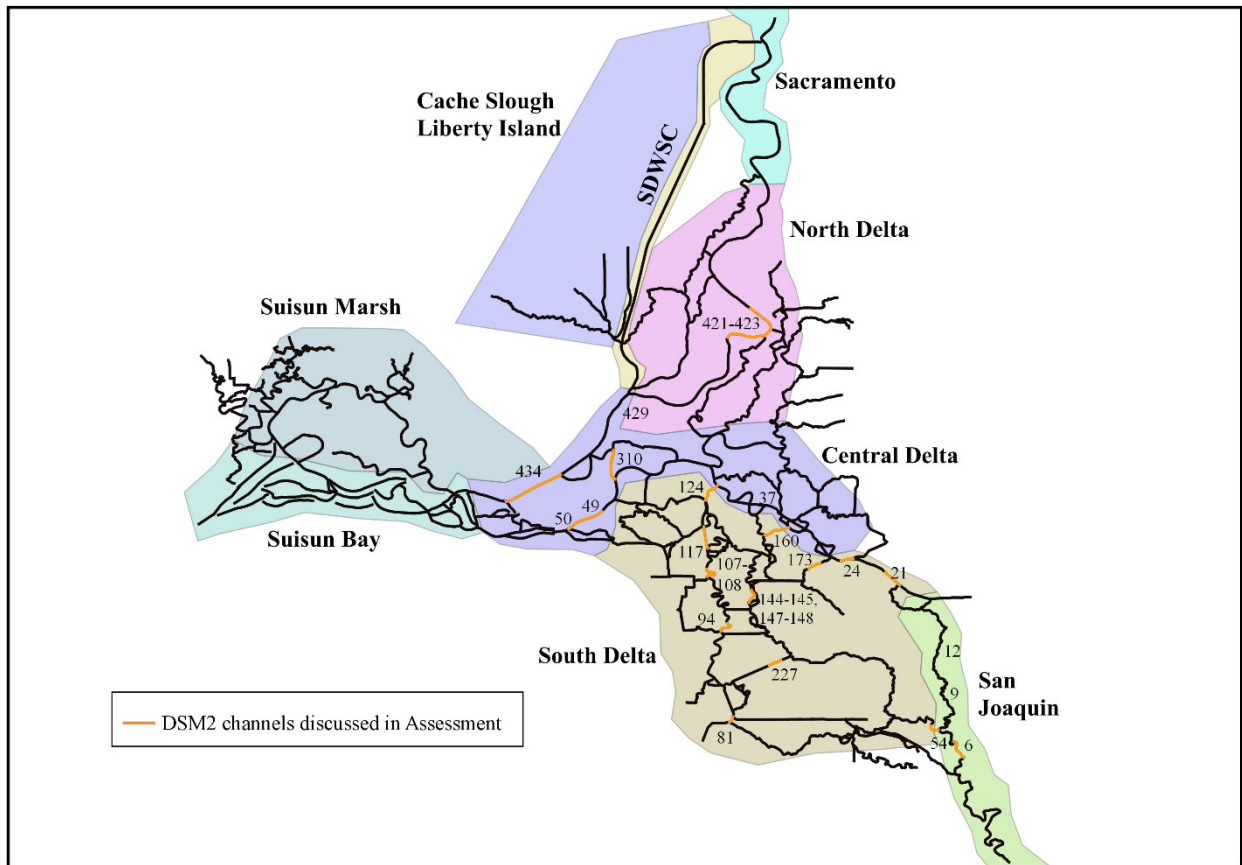


FIGURE A5. Highlighted DSM2 channels by Delta Strata.

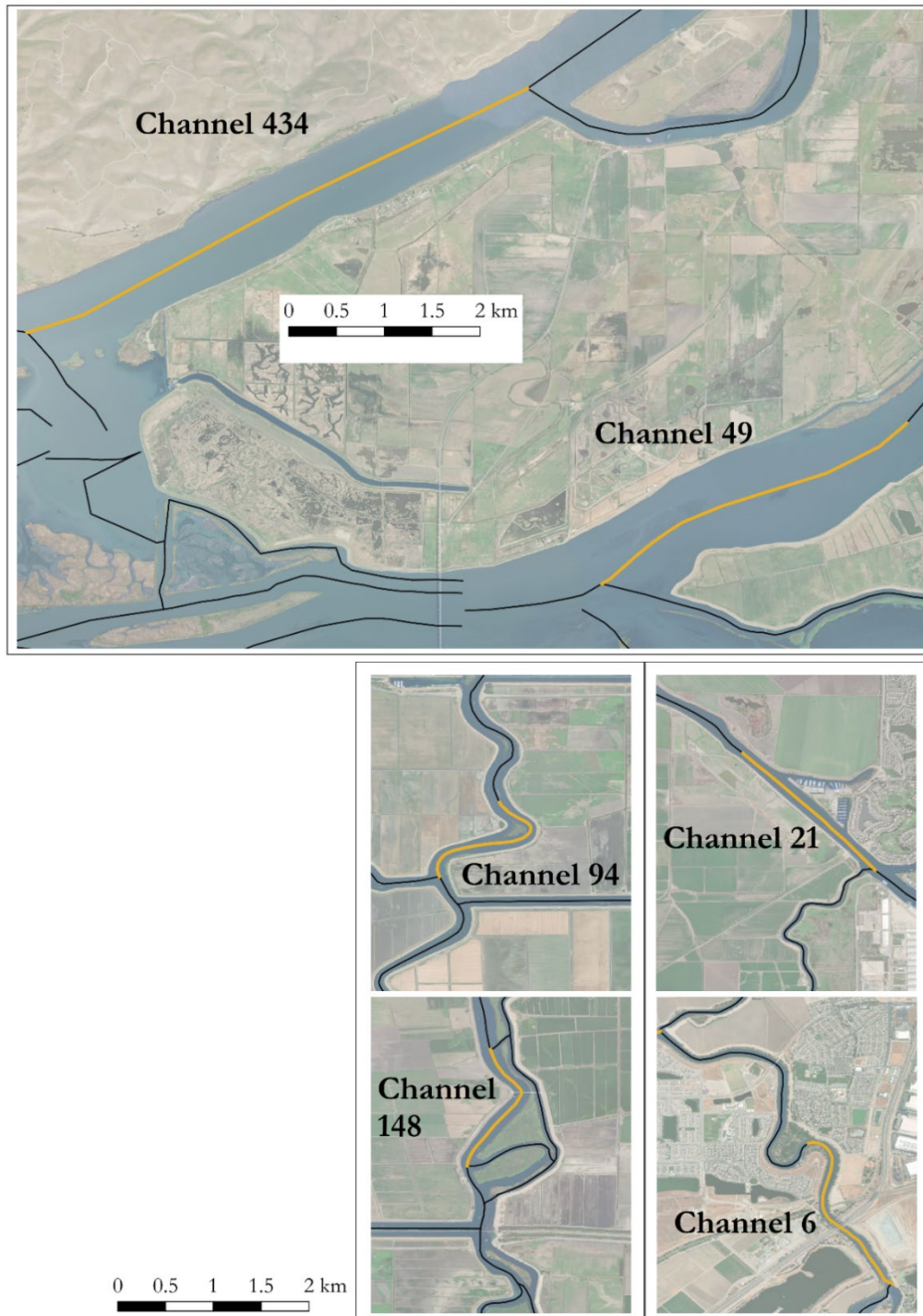


FIGURE A6. Aerial imagery of several DSM2 channels discussed in Proposed Action Assessment. North Delta (channels 434 and 49, top panel), San Joaquin River and Central Delta (channels 6 and 21, bottom panel on right), and South Delta (channels 94 and 148, bottom panel on left). Scale for all channels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

Update for 3/29/2022 was not available at the time of drafting.

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

Delta Turbidity Conditions Report

For conditions through: March 20, 2022

General Conditions:

Inflows:

Freeport	9016 cfs
Yolo Bypass	40 cfs
Vernalis	851 cfs
Cosumnes	331 cfs
Mokelumne	64 cfs
Calaveras	27 cfs

Exports:

Clifton Court	594 cfs
Jones	902 cfs

Other:

OMR (Index)	-1273 cfs
QWEST	1158 cfs
NDOI	7943 cfs

Delta Daily Turbidity Trend Through 03/20/2022

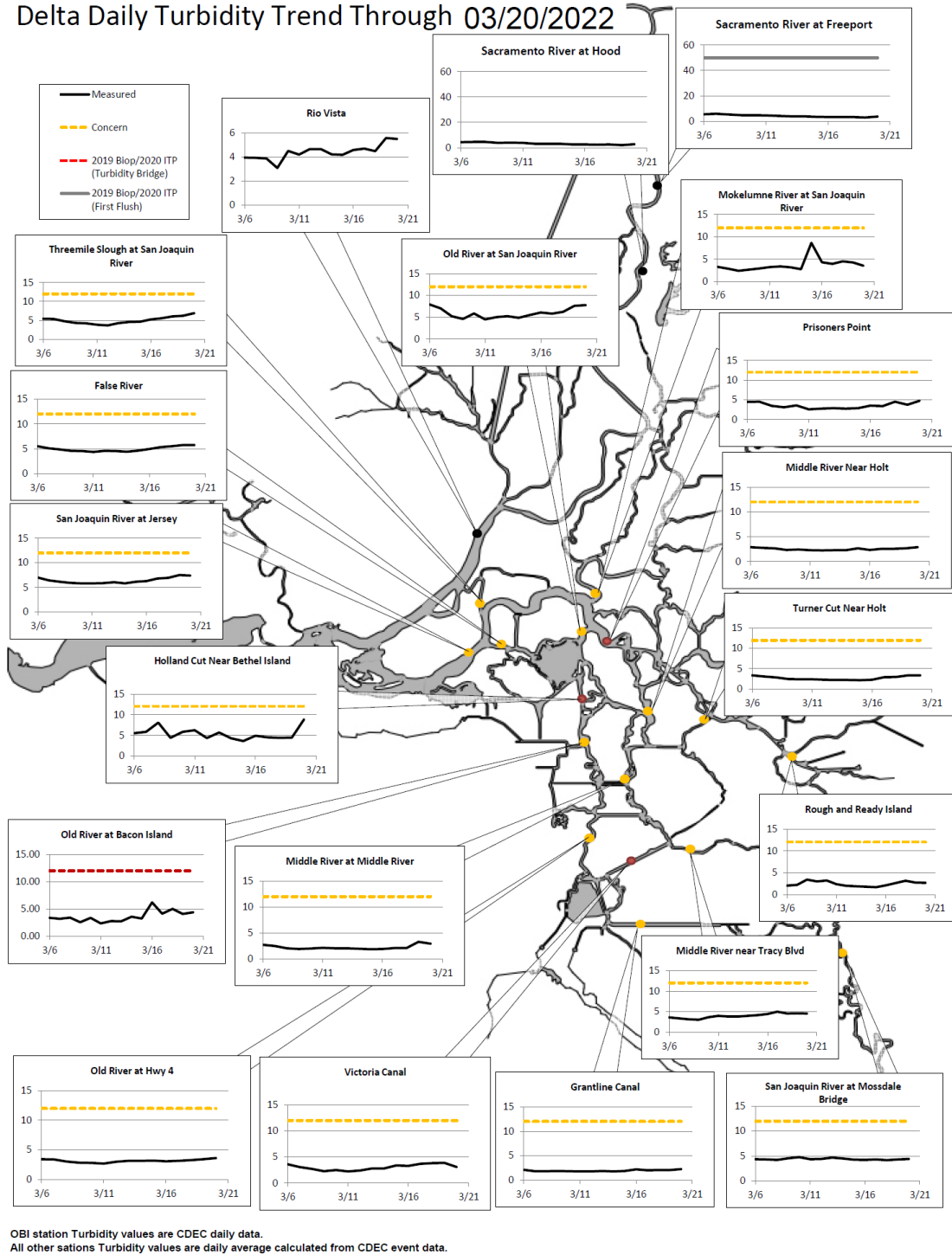


Figure 2. Delta Daily Turbidity Trends Through 03/20/2022

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 Prob 2	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
 3/1/2022

Sample Date	FL*	JD**	ots28	Sex	Assignment	Pos Prob 1	Grp	Pos Prob 2	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