

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 December 28 – January 3

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 Federal fish salvage facility (provisional WY 2022 total loss = 6.12 fish, as of 12/26/2021). 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. 35-39% 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. Larger, older juveniles were observed that may be yearling spring run. 15-20% 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 not occurred in the past week at the State and Federal fish salvage facilities. 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. 10-14% 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. 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 distribution patterns over the past decade and rare detections, Delta Smelt are unlikely to be prevalent in the South Delta. Limited detection data support Delta Smelt being present in the Sacramento Deep Water Ship Channel, Lower San Joaquin River and the Lower Sacramento River. Six tagged individuals have been collected since 12/21/2021. The implementation of Early Winter Pulse Protection is expected to reduce the chance that migrating Delta Smelt will move into areas with a high likelihood of entrainment. The likelihood of Delta Smelt adult entrainment remains low given the most recent detections, persistent low turbidity in the south delta and the expected OMR index range over the next seven days.

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: Juvenile production estimate (JPE) calculations have not been established for brood year (BY) 2021 winter-run Chinook salmon. The agencies in the winter-run Chinook salmon JPE project work team (WR JPE PWY) has met in several times in December 2021 to begin formulating the JPE. 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 12/16/2021 for the last 18 years of passage data is 95.5% (one SD of 3.8%). By 12/16/2021, 559,801 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: No hatchery winter-run Chinook salmon have been released in WY 2022.

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 17.0% juvenile spring-run sized Chinook salmon have been observed passing Red Bluff Diversion dam as of 12/19 based on historical data.
- Hatchery spring-run Chinook salmon surrogates:

- 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.
- 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.
- 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.

DISTRIBUTION

Winter-run Chinook Salmon

Current Distribution:

- On 12/28/2021, SaMT estimated 40-49% of juvenile winter-run Chinook salmon were present in the Delta and 0-1% were estimated to have exited the Delta (Table 1). The SaMT estimate is largely based on historical trends since few winter-run Chinook salmon have been seen in recent monitoring. The SaMT expressed some concern that these numbers seem low especially given the recent precipitation events.
- Combined total natural winter-run Chinook salmon loss equals 6.12 fish (provisionally, as of 12/26/2021).
- Since 9/1/2021, the Glenn Colusa Irrigation District (GCID) rotary screw traps (RSTs) have observed over 140 winter-run Chinook Salmon juveniles (by length at date criteria) in their daily catches. Fish have been steadily arriving since the beginning of October. GCID RST cone was removed from the bypass channel on 12/10/2021 through 12/20/2021 due to anticipation of high water flows. On 12/20/2021 the cone was put back into the bypass channel but was removed again on 12/23/2021 due to high water flows.
- Winter-run Chinook Salmon have been observed in RST monitoring locations farther downstream (Knights Landing, Beach Seines) and the fish appear to 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 every day during the past week.

Historic Trends

- Based on historical trends in salvage, 8.4% 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.

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 significant precipitation events could 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

Spring-run Chinook salmon

Current Distribution

- On 12/28/2021, SaMT estimated 15-20% of young of year CV spring-run Chinook salmon were present in the Delta (Table 1).
- Spring-run chinook are being observed at upstream monitoring sites including Tisdale, Knights Landing, Beach Seines, on the Feather River and Butte Creek.

Historical Trends

- Based on historical trends in salvage, 0% 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 is unlikely to increase over the next week.

Forecasted Distribution within Central Valley and Delta regions

- On 12/28/2021 SaMT noted that some juvenile CV YOY spring-run Chinook Salmon have yet to emerge. Furthermore, larger, older juveniles were observed that may be yearling spring run. Yearling CV spring run Chinook Salmon are likely beginning to move 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 5).

Central Valley Steelhead

Current Distribution

- On 12/28/2021 SaMT estimated 10-14% of juvenile CCV steelhead were present in the Delta (Table 1).
- Combined total loss of hatchery steelhead equals 24.37 fish as of 12/26/2021.
- Combined total loss of natural steelhead between December 1 and March 31 equals 3.4 fish as of 12/26/2021.

Historical Trends

- Based on historical trends in salvage, 0.5% (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 is likely to not increase over the next week. However, since a few fish have been observed in salvage in WY 2022 earlier than in previous years, it is possible loss of CCV steelhead could occur over the next week.

Forecasted Distribution within Central Valley and Delta regions

- Natural steelhead were observed in key monitoring locations this past week (Knights Landing).
- SaMT estimated that 10-14% 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.

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	50-60%	40-49%	0-1%
YOY spring-run Chinook salmon	80-85%	15-20%	0%
YOY hatchery winter-run Chinook salmon*	NA	NA	NA
Natural origin steelhead	85-90%	10-14%	0-1%

Table 2. Catch indices for juvenile winter-run Chinook salmon observed in RSTs at Knights Landing (Knights Landing Catch Index, KLCI) and Sacramento Trawl and Beach Seine (Sacramento Seine Catch Index, SCI Trawl and SCI Beach Seine) monitoring locations

Date	KLCI	SCI Trawl	SCI Seine	Trigger Exceeded
12/21	1	0	N/A	N/A
12/22	1.2	0	0	N/A
12/23	0	0	1.6	N/A
12/24	0.6	N/A	N/A	N/A
12/25	No Trapping	N/A	N/A	N/A
12/26	No Trapping	1	N/A	N/A
12/27	N/A	1	2.67	N/A

Table 3. Historic migration and salvage patterns.

Date (12/26)	Red Bluff Diversion Dam	Tisdale RST	Knights Landing RST	Sac Trawl (Sherwood) Catch Index	Chippis Island Trawl Catch Index	Salvage
Chinook, Winter-run, Unclipped	95.7% (93.6%, 97.8%)	57.9% (31.7%, 84.1%)	54.8% (25.8%,83.9%)	30.5% (3.0%,58.0%)	1.4% (- 1.1%,3.9%)	8.4% (-1.7%,18.5%) WY: 2012 - 2021
Chinook, Spring-run, Unclipped	17.8% (4.5%,31.2%)	19.9% (- 3.8%,43.5%)	15.1% (-4.6%,34.7%)	3.8% (- 3.3%,10.9%)	0.0% (0.0%,0.0%)	0.0% (0.0%,0.0%) WY: 2012 - 2021
Steelhead, Unclipped (December - March)	N/A	N/A	N/A	N/A	N/A	0.5% (-0.1%,1.2%) WY: 2012 - 2021

Table 4. STARS model output.

Date (12/27)	DCC	Georgiana Slough	Sacramento River	Sutter and Steamboat
Proportion of Entrainment	0	0.2	0.47	0.32
Survival	NA	0.28	0.66	0.62
Travel Time	NA	11.7d	6.5d	7.2d

Table 5. 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 temp. (°F)	Alert Triggered
12/26/2021	583.8	-32.8%	Flow>95 cfs	800.4	-34.0%	Flow>95 cfs	17946.9		

Proposed Action Assessment

12/28/2021

Date	Mill Creek flow (MLM)	MLM Change	MLM Alert	Deer Creek flow (DCV)	DCV Change	DCV Alert	Wilkins Slough flow (WLK)	Knights Landing temp. (°F)	Alert Triggered
12/25/2021	868.6	4.0%	Flow>95 cfs	1213.2	-15.4%	Flow>95 cfs	19646.4	N/A	N/A
12/24/2021	835.2	-11.2%	Flow>95 cfs	1433.5	31.8%	Flow>95 cfs	13825.1	N/A	N/A
12/23/2021	941.0	289.1%	Flow>95 cfs Change>50%	1087.8	328.3%	Flow>95 cfs Change>50%	7981.2	N/A	N/A
12/22/2021	241.8	39.1%	Flow>95 cfs	254.0	38.9%	Flow>95 cfs	7586.8	39.6	WLK>750 cfs and KNL<56.3 F
12/21/2021	173.8	-7.0%	Flow>95 cfs	182.8	-9.5%	Flow>95 cfs	8403.2	39.6	WLK>750 cfs and KNL<56.3 F
12/20/2021	186.9	-10.3%	Flow>95 cfs	202.1	-11.2%	Flow>95 cfs	9758.6	38.8	WLK>750 cfs and KNL<56.3 F

EVALUATION

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

This question is not applicable until 1/1/2022. Greater than 5% of juvenile winter-run Chinook salmon, CCV steelhead and young of year spring-run Chinook salmon may be 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.

This question is not applicable until 1/1/2022. However, OMR flow is expected to remain at or below -5,000 this upcoming week.

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

Not applicable, 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 6.12 fish (provisionally, as of 12/26/2021). Loss of juvenile winter-run Chinook salmon has occurred in the past week at the CVP and SWP fish salvage facilities. JPE calculations have not been established for brood year (BY) 2021 winter-run Chinook salmon. 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.

Spring-run Chinook salmon

Total juvenile spring-run Chinook salmon (LAD) loss is 0 fish (as of 12/26/2021). No 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.

Central Valley Steelhead

Total natural juvenile steelhead loss (December 1 through March 31) is 3.4 fish (as of 12/26/2021). No loss of natural juvenile has occurred in the past week at the CVP and SWP fish salvage facilities. Total clipped steelhead loss is 24.37 fish (as of 12/26/2021). 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.

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 annual loss threshold for winter-run Chinook salmon has not been exceeded in WY 2022.

Spring-run Chinook salmon

The annual loss threshold for spring-run Chinook salmon has not been exceeded in WY 2022.

Central Valley Steelhead

The annual loss threshold 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. This question is not applicable until 1/1/2022.

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.
- 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.

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 12/26/2021). 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:

Adults

Brood Year 2021:

Abundance estimate:

The abundance estimate for Delta Smelt was 6,395 and calculated from data collected between 12/20-23/2021. Abundance estimates are only generated from unmarked fish and does not account for tagged fish in its calculations. The most recent detection of Delta Smelt was on 12/28/2021 (adipose clipped) (EDSM) caught in the Lower Sacramento Stratum.

Biological Conditions:

Adult Delta Smelt are expected to be present in the Sacramento Deep Water Ship Channel, the Lower Sacramento and Lower San Joaquin River based on the survey detections. Delta Smelt should be migrating in response to increases in turbidity and flow from “first flush” conditions (Sommer et al 2011). 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, Chipps Island, Bay Study, SLS, and FMWT. 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 12/28/2021 in the Lower Sacramento stratum.
- Larval sampling at the Skinner Fish Facility (SFF) and the Tracy Fish Collection Facility (TFCF) will be initiated by the SMT in February.

TABLE 6. Summary of recently reported detections of Delta Smelt by Region and Salvage Facilities between 12/20/2021 and 12/28/2021. 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.

Life Stage	North	South	West	Far West	Salvage
Adult	2	0	0	0	0
Larvae/Juvenile	4	0	0	0	0

Table 7. 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 received full QA/QC, but any corrections will be made the following week.

Sampling Method	Frequency	New Detections	WY2022	Notes
EDSM	Weekly	6	15	Phase 1 began 11/29/2021 Western Delta stratum sampling cancelled. Additional sites will be selected from Suisun Bay stratum
SKT	Monthly	0	0	Begins: 1/18/2022
SLS	Biweekly	0	0	Ongoing Survey 13 Processing Survey 12
20-mm	Biweekly	0	0	Begins: 3/21/2022
Summer Trawnet	Biweekly	0	0	Complete
Bay Study	Monthly	0	0	Ongoing
FMWT	Monthly	0	0	Ongoing
Chipps Island Trawl	Weekly	0	0	Ongoing
FCCL Brood Stock Collections	Weekly	0	0	November
LEPS	Weekly	0	0	Start date under consideration or by 1/3/2022
Total	N/A	N/A	0	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 11392 Adipose fin clipped individuals and 1408 Visible Implant Elastomer (VIE) tagged individuals.

Table 8. Weekly summary of the origin of Delta Smelt caught. 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	Stratum	Total Caught	Ad. Clipped	VIE	No Tag
12/23/2021	Lower Sacramento	2	2	0	0
12/23/2021	Lower San Joaquin	1	1	0	0
12/27/2021	Lower Sacramento	1	1	0	0
12/28/2021	Lower Sacramento	2	2	0	0

Historical Trends

- 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. No detections have been in the central or south delta.
- 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 12/28/2021 turbidity continues to be less than 12 FNU at OBI, and it is stable at other central and south Delta stations (See attachment A). However, south Delta turbidity may increase due to precipitation and may influence the distribution of Delta Smelt and the likelihood of entraining Delta Smelt in the next seven days.
- On 12/18/2021 flow and turbidity conditions at Freeport met the criteria for Integrated Early Winter Pulse Protection. Integrated Early Winter Pulse Protection will continue until 1/2/2021.
- Precipitation has occurred and is expected in the next seven days which may increase turbidity and flows.

Table 9. Relevant Environmental Factors to the current management actions for Delta Smelt.

Date Reported	OBI Daily Turbidity (FNU)
12/27/2020	2.99

X2 Conditions

- X2 is estimated to be at 68 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 -1,800 to -5,000 cfs from 12/28/2021 to 1/04/2021.
- 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

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 (Table 6) 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 beginning on 12/20/2021 and will continue for 14 consecutive days, 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 distribution patterns over the past decade and recent detection data, Delta Smelt are unlikely to be prevalent in the South Delta. Since “first flush” conditions were met and Early Winter Integrated Pulse Protection was implemented, the zone of influence of the export facilities has been reduced, making Delta Smelt less likely to be entrained. Low turbidity persists in the regions with an increased likelihood of entrainment and migratory Delta Smelt are expected to move into areas of higher turbidity.

3. Has a spent female been collected?

As of 12/28/2021 no spent female Delta Smelt has been collected.

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

OBI turbidity is currently below 12 FNU and a turbidity bridge avoidance action cannot be taken until 1/3/2022 when early integrated winter pulse protection ends.

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 12/27/2021 at Prisoners Point (10.65 NTU), Holland Cut (4.10 FNU) and Victoria Canal (2.18 NTU) are stable and may increase in the next seven days due to past and forecasted precipitation.

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, but may increase due precipitation. A turbidity bridge avoidance action cannot be taken until 1/3/2022 when early integrated winter pulse protection ends.

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?

This question is not applicable until March 15th.

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?

This question is not applicable until March 15th.

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?

This question is not applicable until March 15th

DELTA SMELT REFERENCES

- 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
- 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). <https://doi.org/10.1038/s41598-019-52273-8>
- 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). <https://doi.org/10.1007/s12237-017-0277-3>
- 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: Delta Turbidity Report

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

Delta Turbidity Conditions Report

For conditions through: December 27, 2021

General Conditions:

Inflows:

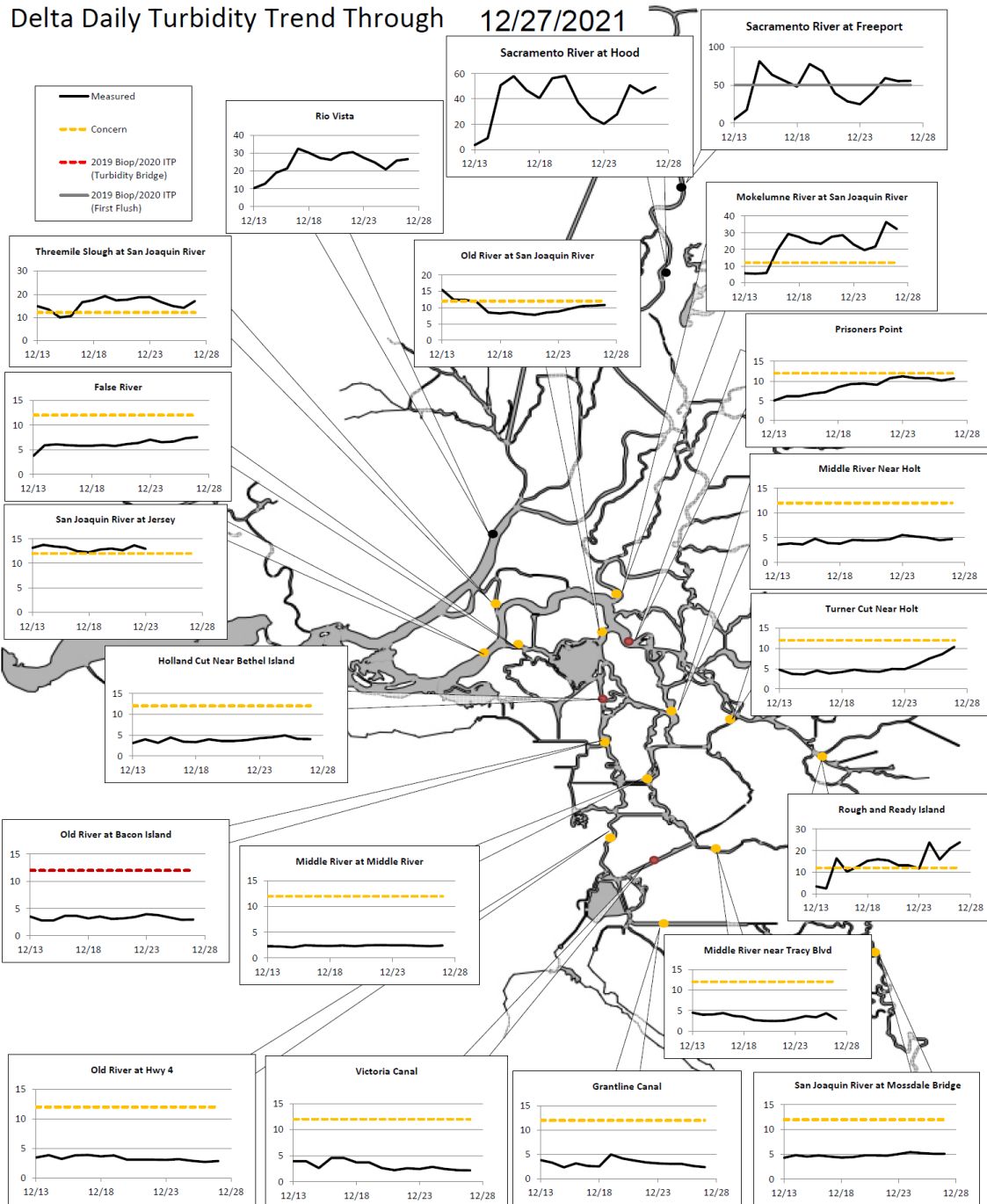
Freeport	34870 cfs
Yolo Bypass	491 cfs
Vernalis	1600 cfs
Cosumnes	3731 cfs
Mokelumne	210 cfs
Calaveras	67 cfs

Exports:

Clifton Court	793 cfs
Jones	1697 cfs

Other:

OMR (Index)	-2044 cfs
QWEST	11189 cfs
NDOI	42838 cfs



OBI station Turbidity values are CDEC daily data.
 All other stations Turbidity values are daily average calculated from CDEC event data.

Figure 2. Delta Daily Turbidity Trends Through 12/27/2021