

# FINAL State Water Project Incidental Take Permit Risk Assessment for Winter-run and Spring-run Chinook Salmon

## Section 1: Overview

Date: 6/8/2021

Life Stages Present:

Winter-run Chinook Salmon (juvenile)

Winter-run Chinook Salmon (adult)

Spring-run Chinook Salmon (juvenile)

Spring-run Chinook Salmon (adult)

Advice to the Water Operations Management Team (WOMT):

No advice is warranted.

For the week beginning 6/7/2021, Delta Outflow is currently controlling exports with Delta Water Quality likely to become controlling during the week.

Combined exports were 1,100 cfs on 6/8/2021 and are projected to remain at 1,100 cfs during the week resulting in projected Old and Middle River Index (OMRI) of -1,000 cfs to -1,800 cfs. These projected OMRI values are more positive than what would be required if State Water Project Incidental Take Permit Conditions of Approval (COA) thresholds were to be exceeded. Federal exports are expected to shift on 6/10/2021 to the State pumping facilities in an effort to better manage controlling factors.

SaMT has been actively monitoring the salmonid components of the COA 8.8 (End of OMR Management) requirements for off-ramping OMR management prior to the end of OMR management season on 6/30/21.

The salmonid requirements are:

- more than 95% of winter-run Chinook salmon (WR) and spring-run Chinook salmon (SR) have migrated past Chipps Islands as determined by SaMT,
- daily average water temperature at Mossdale exceeds 22.2° C (72° F) for 7 non-consecutive days in June, and
- daily average water temperature at Prisoner's Point exceeds 22.2° C (72° F) for 7 non-consecutive days in June.

SaMT has determined that greater than 95% of WR and SR have migrated past Chipps Island. In addition, both the Prisoner's Point and Mossdale temperature off-ramp requirements have been exceeded for the requisite number of days in June. Therefore, the salmonid requirements for COA 8.8 have been met. OMR management may continue for Delta smelt and Longfin smelt.

The COA 8.6.1 (WR Single-year Loss Threshold) was not exceeded this OMR management season as reflected by low cumulative loss of natural origin and hatchery origin WR at the export facilities. Cumulatively, for Water Year (WY) 2021, 5 length at date (LAD) size natural origin WR have been salvaged, resulting in a loss of 8 fish, and 7 LAD size hatchery WR (without CWT readings) have been salvaged, resulting in loss of 16 fish. Salvage of hatchery origin WR is preliminary and may be adjusted based on CWT reading corrections.

The COA 8.6.3 (Mid- and Late-season Natural WR Daily Loss Threshold) ended on 5/31/2021. No exceedances occurred during this OMR management season.

COA 8.6.4 (Daily SR Hatchery Surrogate Loss Threshold) was not exceeded this OMR season. No salvage of SR surrogate groups was documented in salvage at the export facilities.

### **Risk Assessment:**

Section 1-A: Sacramento River and Confluence

**Assessment of risk of entrainment into the central Delta for WR and SR in the Sacramento River:** (8.1.5.1 C ii, iii, iv and 8.1.5.1 B iii)

- Exposure Risk:
  - WR: Low
  - SR: Low
- Routing Risk:
  - WR: Low
  - SR: Low
- Overall Entrainment Risk:
  - WR: Low
  - SR: Low
- Change in risk of entrainment into the central Delta (increased/decreased risk compared to last week):
  - WR: SaMT estimates that 0% of WR are yet to enter the Delta and 0-1% of WR are present in the Delta. Therefore, the exposure, routing, and overall risk of entrainment for WR into the central Delta are characterized as low. The risk for WR entrainment into the central Delta for this OMR management season is likely complete as of 6/8/2021.
  - SR: SaMT estimates that 0-1% of SR have yet to enter the Delta and 0-1% of SR are present in the Delta. Therefore, the exposure, routing, and overall risk of entrainment for SR into the central Delta are characterized as low. The risk assessment for SR entrainment into the central Delta for this OMR management season is likely complete as of 6/8/2021. There was a significant, but warranted, shift in the SaMT estimate for the in-Delta distribution of SR from 5-15% last week to 0-1% this week. This shift was based largely on historical patterns of SR in-Delta distribution and represents corrections from likely overestimation of SR Delta presence in recent weeks. This overestimation is due a number of factors including: low detection at sampling stations, suspected low overall Delta survival, and length at date (LAD) size overlap between natural origin SR and hatchery origin fall-run Chinook salmon which led to difficulty in estimating SR distribution.

Section 1-B: Facilities Risk

**Central Valley Project/State Water Project (CVP/SWP) facilities entrainment risk for WR and SR in the central Delta over the next week** (8.1.5.1 D iii, iv, v)

- Exposure Risk:
  - WR: Low
  - SR: Low
- Reporting OMR/Export Risk:

- Baseline OMR (-1,200 cfs)
  - WR: Low
  - SR: Low
- Scenario 1 N/A
  - WR: N/A
  - SR: N/A
- Scenario 2 N/A
  - WR: N/A
  - SR: N/A
- Overall Entrainment Risk:
  - WR: Low
  - SR: Low
- Change in risk of entrainment into the facilities (increased/decreased risk compared to last week):
  - WR: SaMT estimates that 0% of WR are yet to enter the Delta and 0-1% of WR are present in the Delta. Therefore, the exposure, routing, and overall risk of entrainment into the export facilities are characterized as low. The risk assessment for WR entrainment into facilities for this OMR management season is likely complete as of 6/8/2021.
  - SR: SaMT estimates that 0-1% of SR have yet to enter the Delta and 0-1% of SR are present in the Delta. Therefore, the exposure, routing, and overall risk of entrainment into the export facilities are characterized as low. The risk assessment for SR entrainment into facilities for this OMR management season is likely complete as of 6/8/2021. There was a significant, but warranted, shift in the SaMT estimate for the in-Delta distribution of SR from 5-15% last week to 0-1% this week.

#### Section 1-C: Annual Loss Threshold Risk

- Annual loss threshold risk and Alternative Actions (8.1.5.1. E I, ii, iii and 8.1.5.1 FI, ii)
  - Loss at the SWP and CVP facilities compared to the estimated remaining population in Delta and upstream of the Delta: No salvage of natural origin or hatchery origin WR LAD has occurred over the past week.
    - Define risk of hitting a threshold, 50%, or 75%, or 100%, and likelihood of exceeding a threshold:
      - Natural origin WR: 3,863 [1.17% of the final natural origin WR Juvenile Production Estimate (JPE)]
        - Current Annual Loss: 8
        - 50% Threshold based on natural WR JPE: 1,931
          - Risk of exceeding threshold: None
        - 75% Threshold based on natural WR JPE: 2,897
          - Risk of exceeding threshold: None
        - 100% Threshold based on natural WR JPE: 3,862
          - Risk of exceeding threshold: None
      - Hatchery WR: 117 (0.12% of the Final Livingston Stone National Fish Hatchery (LSNFH) hatchery release JPE)

- Current Annual Loss: 16<sup>1</sup>
- 50% Threshold based on hatchery WR JPE: 59
  - Risk of exceeding threshold: None
- 75% Threshold based on hatchery WR JPE: 88
  - Risk of exceeding threshold: None
- 100% Threshold based on hatchery WR JPE: 117
  - Risk of exceeding threshold: None

Section 1-D: Daily Loss Threshold Risk\*

- Daily loss threshold risk and Alternative Actions
  - Loss at the SWP and CVP facilities compared to estimated remaining population in Delta and upstream of the Delta:
    - Daily loss thresholds hit and subsequent loss and associated operations:
      - COA 8.6.3 Mid- and Late-season Natural WR Daily Loss Threshold (defined as natural origin older juvenile Chinook salmon<sup>2</sup>):
        - January:  $0.0000635 * 330,130 = 20.96$
        - February:  $0.0000991 * 330,130 = 32.72$
        - March:  $0.000146 * 330,130 = 48.20$
        - April:  $0.0000507 * 330,130 = 16.74$
        - May:  $0.000077 * 330,130 = 25.42$
        - June: Not in Effect
        - Natural Origin Older Juvenile Chinook Salmon- Highest daily loss: 4.33
          - Risk of exceeding threshold: N/A
      - COA 8.6.4 Daily SR Hatchery Surrogate Loss Threshold<sup>3</sup>:
        - Hatchery Origin Young-of-Year (YOY) SR Surrogates
          - FRH Group 1: 514,027 released 3/19/2021
            - 0.25% threshold = 1285.07 fish
            - Cumulative Loss: 0
            - Risk of exceeding threshold: None
          - FRH Group 2: 500,312 released on 4/1/2021
            - 0.25% threshold = 1,250.78 fish
            - Cumulative Loss: 0
            - Risk of exceeding threshold: None
        - Hatchery Origin YOY FR Surrogates
          - CNFH Group 1: 322,538 released on 3/10/2021
            - 0.25% threshold = 806.35 fish
            - Cumulative Loss: 0

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<sup>1</sup> Loss is currently based on Delta Model length-at-date data and is subject to revision based on reading of CWTs.

<sup>2</sup> Condition applies to all older juvenile Chinook salmon is defined as any Chinook salmon that is above the minimum length for WR, according to the Delta Model length-at-date criteria used to assign individuals to race.

\*Daily Loss Threshold Risk is over for this OMR season.

<sup>3</sup> The number of fish released in each group represents the number of fish with an adipose fin clip and CWT.

- Risk of exceeding threshold: None
- CHNF Group 2: 372,072 released on 3/24/2021 and 3/26/2021
  - 0.25% threshold = 930.18
  - Cumulative Loss = 0
  - Risk of exceeding threshold: None
- CHNF Group 3: 1,347,465 released on 4/8/2021
  - 0.25% threshold = 3,368.66
  - Cumulative Loss = 0
  - Risk of exceeding threshold: None

Section 2: Basis for Advice:

The 2020 [Incidental Take Permit for Long-Term Operation of the State Water Project in the Sacramento-San Joaquin Delta 2081-2019-066-00](#) (SWP ITP) states that advice to Water Operations Management Team (WOMT) shall be consistent with the Project Description, COA in the ITP, and the applicable ESA authorizations. This week's advice is based on the following COAs which are currently applicable:

*List relevant COA number and title based on species/life stage, time of year, etc.*

*8.1.4 Collaborative Approach to Real-time Risk Assessment. Beginning no later than October 1 through the end of OMR Management (see Condition of Approval 8.8) the Smelt and Salmon Monitoring Teams shall meet weekly, or more often as required, to consider survey data, salvage data, and other pertinent biotic and abiotic factors and prepare risk assessments as described in Conditions of Approval 8.1.1, 8.1.2, 8.1.5.1 and 8.1.5.2.*

*The Smelt and Salmon Monitoring Teams shall prepare operations advice for the WOMT as required by Conditions of Approval 8.3.1, 8.3.3, 8.4.1, 8.4.2, 8.5.1, 8.5.2, 8.6.1, 8.6.2, 8.6.3, 8.6.4, 8.7, and 8.8, including advice on operations. The Smelt and Salmon Monitoring Teams shall each prepare risk assessments and operations advice. Within each team, staff jointly develop the risk assessment and supporting documentation to accompany operations advice (see Conditions of Approval 8.1.5.1 and 8.1.5.2). DWR and CDFW Smelt and Salmon Monitoring Team staff may conclude different operations advice is warranted, in which case the difference shall be noted and elevated as described in this Condition of Approval.*

*The Smelt and Salmon Monitoring Teams shall communicate their advice to WOMT. The WOMT shall then confer and attempt to reach a resolution and agreed-upon Project operations. If a resolution is reached, Permittee shall operate consistent with the decision regarding Project operations from WOMT. If the WOMT does not reach a resolution, the CDFW Director may require Permittee to implement an operational recommendation provided by CDFW. CDFW will provide its operational decision to Permittee in writing. Permittee shall implement the operational decision required by CDFW. Permittee shall ensure that its proportional share (see Condition of Approval 8.10) of the OMR flow requirement as a part of the operational decision is satisfied.*

*8.1.5 Real-time Risk Assessments. The Smelt and Salmon Monitoring Teams (Conditions of Approval 8.1.1 and 8.1.2) shall prepare weekly risk assessments, or more often as required, and operations advice (as required by Conditions of Approval 8.3.1, 8.3.3, 8.4.1, 8.4.2, 8.5.1, 8.5.2, 8.6.1, 8.6.2, 8.6.3, 8.6.4, and 8.7) during their discussions and analyses. The Smelt and Salmon Monitoring Teams shall provide the risk assessments and*



*pertinent supporting information to the WOMT (Condition of Approval 8.1.3) within one business day of each meeting.*

*8.3.2 Salmonid Presence. After January 1 each year, if Conditions of Approval 8.3.1 or 8.3.3 have not already been triggered, the OMR Management season shall begin when the Salmon Monitoring Team first estimates that 5% of the WR or SR population is in the Delta whichever is sooner. Upon initiation of the OMR Management season, Permittee shall reduce exports to achieve, and shall maintain a 14-day average OMR index no more negative than -5,000 cfs, until the OMR Management season ends (see Condition of Approval 8.8). In the event that a salmon daily or single-year loss threshold is exceeded (Conditions of Approval 8.6.1, 8.6.2, 8.6.3, or 8.6.4) prior to the start of OMR Management season the requirements in those Conditions shall control operations.*

*8.6.1 Winter-run Single-year Loss Threshold. In each year, Permittee shall, in coordination with Reclamation, operate the Project to avoid exceeding the following single-year loss thresholds:*

- Natural WR (loss = 1.17% of natural WR JPE)*
- Hatchery WR (loss = 0.12% of hatchery WR JPE)*

*The loss threshold and loss tracking for hatchery WR does not include releases into Battle Creek.*

*Loss of WR at the CVP and SWP salvage facilities shall be calculated based on LAD criteria for run assignment.*

*Annual loss of natural and hatchery WR at the CVP and SWP salvage facilities shall be counted cumulatively beginning November 1 each calendar year through June 30 the following calendar year.*

*WR shall be identified based on the Delta Model LAD criteria. Loss shall be calculated for the South Delta Export Facilities using the 2018 CDFW loss equation (Attachment 6).*

*During the water year, if cumulative loss of natural or hatchery WR exceeds 50% of the annual loss threshold, Permittee shall restrict south Delta exports to maintain a 14-day average OMR index no more negative than -3,500 cfs through the end of OMR Management (see Condition of Approval 8.8). After 14 days of operations to maintain an OMR index no more negative than -3,500 cfs, Permittee may convene the Salmon Monitoring Team to conduct a risk assessment (Condition of Approval 8.1.5.1) and determine whether the risk of entrainment and loss of natural and hatchery WR is no longer present. Risks shall be measured against the potential to exceed the next single-year loss threshold. The results of this risk assessment and associated OMR advice shall be provided to WOMT according to Condition of Approval 8.1.3 and the decision-making process shall follow the process described in Condition of Approval 8.1.4.*

*The -3,500 cfs OMR flow operational criteria, adjusted and informed by this risk assessment, shall remain in effect until the end of OMR Management (Condition of Approval 8.8).*

*During the water year, if cumulative loss of natural or hatchery WR at the CVP and SWP salvage facilities exceeds 75% of the single-year loss threshold, Permittee shall restrict OMR to a 14-day moving average OMR flow index that is no more negative than -2,500 cfs through the end of OMR Management (Condition of Approval 8.7). After 14 days Permittee may convene the Salmon Monitoring Team to conduct a risk assessment (Condition of Approval 8.1.5.1) and determine whether the risk of entrainment and take of natural and hatchery WR is no longer present. The results of this risk assessment and associated OMR advice shall be*

provided to WOMT according to Condition of Approval 8.1.3 and the decision-making process shall follow the process described in Condition of Approval 8.1.4.

The -2,500 cfs OMR flow operational criteria adjusted and informed by this risk assessment shall remain in effect until the end of OMR Management (Condition of Approval 8.8).

During the water year, if natural or hatchery WR cumulative loss at the CVP and SWP salvage facilities exceeds the single-year loss threshold, Permittee shall immediately convene the Salmon Monitoring Team to review recent fish distribution information and operations and provide advice regarding future planned Project operations to minimize subsequent loss during that year. The Salmon Monitoring Team shall report the results of this review and advice to the WOMT (see Condition of Approval 8.1.3). Operational decisions shall be made following the process described in Condition of Approval 8.1.4 (Collaborative Real Time Risk Assessment).

If the single-year loss threshold is exceeded, Permittee and Reclamation shall also convene an independent panel to review Project operations and the single-year loss threshold prior to November 1, as described in Condition of Approval 8.2. The purpose of the independent panel is to review the actions and decisions contributing to the loss trajectory that lead to an exceedance of the single-year loss threshold, and make recommendations on modifications to Project implementation, or additional actions to be conducted to stay within the single-year loss threshold in subsequent years.

Permittee shall, in coordination with Reclamation, continue monitoring and reporting salvage at the CVP and SWP salvage facilities. Permittee and Reclamation shall continue the release and monitoring of yearling Coleman National Fish Hatchery (NFH) late fall-run and yearling SR surrogates. The Salmon Monitoring Team shall use reported real-time salvage counts along with qualitative and quantitative tools to inform risk assessments (see Condition of Approval 8.1.5.1).

**8.6.4 Daily Spring-run Chinook Salmon Hatchery Surrogate Loss Threshold.** To minimize entrainment of emigrating natural juvenile CHNSR from the Sacramento River and tributaries, including the Feather and Yuba rivers into the channels of the central Delta, south Delta, CCF, and the Banks Pumping Plant, Permittee shall restrict exports based on the presence of hatchery produced CHNSR surrogate groups at the CVP and SWP salvage facilities. CHNSR surrogate groups shall consist of all in-river fall- and spring-run surrogate release groups of Chinook salmon from the Coleman National Fish Hatchery, Feather River Hatchery, and the Nimbus Fish Hatchery. Each water year between February 1 and June 30 Permittee shall reduce south Delta exports for five consecutive days to achieve a five-day average OMR index no more negative than -3,500 cfs when:

- Feather River Hatchery coded wire tagged (CWT) CHNSR surrogates (includes both spring- and fall-run hatchery release groups) cumulative loss at the at the CVP and SWP salvage facilities is greater than 0.25% for each release group, OR
- Coleman National Fish Hatchery and Nimbus Fish Hatchery CWT fall-run release groups cumulative loss at the at the CVP and SWP salvage facilities is greater than 0.25% of the total in-river releases for each release group.

This Condition of Approval may be modified through the process described in Condition of Approval 8.6.6 and an amendment to this ITP.



**8.8 End of OMR Management.** Permittee shall operate the Project to meet the requirements included in Conditions of Approval 8.3.1, 8.3.3, 8.4.1, 8.4.2, 8.5.1, 8.5.2, 8.6.1, 8.6.2, 8.6.3, and 8.6.4 to ensure that entrainment and take of Covered Species is minimized during the OMR Management season through June 30, or until the following species-specific off-ramps occur:

- *LFS and DS: Daily mean water temperature at CCF is greater than 25°C (77°F) for three consecutive days.*
- *CHNWR and CHNSR:*
  - *More than 95% of CHNWR and CHNSR have migrated past Chipps Island as determined by the Salmon Monitoring Team, AND*
  - *Daily average water temperature at Mosssdale exceeds 22.2°C (71.96°F) for 7 non-consecutive days in June, AND*
  - *Daily average water temperature at Prisoner's Point exceeds 22.2°C (71.76°F) for 7 non-consecutive days in June*

Discussion of Conditions of Approval

*Provide sentence or two addressing criteria for each Condition of Approval listed in "Basis for Advice" section. Refer to data below where appropriate.*

Per Conditions of Approval 8.1.4 and 8.1.5, SaMT will provide advice and an accompanying risk assessment to WOMT.

SaMT has determined that greater than 95% of WR and SR have migrated past Chipps Island. In addition, both the Prisoner's Point and Mosssdale temperature offramp requirements have been exceeded for the requisite number of days in June. Therefore, the salmonid requirements for COA 8.8 have been met. OMR management may continue for Delta smelt and Longfin smelt. Export operations were not controlled by Conditions of Approval 8.6.1, 8.6.2, 8.6.3 or 8.6.4 at any point during this OMR management season.

### Section 3: Hydrology and Operations

#### Assessment of hydrologic, operational, and meteorological information. 8.1.5.1 A

##### Section 3-A: Water Operations C 8.1.5.1 A. i, iii:

- Antecedent Actions: *(e.g., DCC gate closure and actions such as integrated early winter pulse protection, etc.)*

DCC gates were closed 12/1/2020 and remained closed until mid-May 2021 per Reclamation's PA description of DCC operations. Exceptions during this period included DCC Gate testing which occurred sporadically mid-February and early May (5/5/2021) during the OMR season, generally consisting of brief openings to complete construction activities this year. DCC gates were opened 6/4/2021, but closed on 6/7/2021. They will remain closed this weekend due to salinity concerns in the Delta..
- Current Controlling Factor(s):
  - SWP: D-1641 Delta Outflow
  - CVP: D-1641 Delta Outflow
- Water Temperature:
  - Mossdale (MSD): 25.2°C (73.6°F) on 6/7/2021
    - Number of days threshold exceeded: >7
  - Prisoners Point (PPT): 22.3°C (73.5°F) on 6/7/2021
    - Number of days threshold exceeded: >7
- Tidal Cycle: *(Spring/Neap. Note if tidal cycle has potential to affect south Delta hydrology or X2)*
  - The tidal cycle is moving from spring tide toward neap tide and Threemile Slough salinity compliance location (perTUCP) is being met.
- Turbidity: Not discussed
- Salinity (X2): >81km (upstream of Collinsville) on 6/7/2021
- Hydraulic Footprint *(Provide brief description of hydrologic footprint and summary of relevant DSM2 results)*: DWR conducted DSM2 modeling this week on 6/7/2021. Based on discussion of the model SaMT concluded:
  - North Delta into Interior and Central Delta & San Joaquin River and Central Delta into South Delta & South Delta into facilities  
Channels: 6, 21, 49, 434, 107, 124, 160, 81, 94, and 148  
Survey data show few listed salmonids present. OMR management season has off-ramped for salmonids. North Delta net flows become more negative in magnitude as the forecast period progresses. Other channels net flows become more positive in magnitude. More positive OMR flows mean an increased transit time for fish coming from the San Joaquin via head of Old River (related to channels close to facilities). Agricultural barrier presence will slow fish passage (downstream past the location of the agricultural barriers through the South Delta channels.

##### Section 3-B: Water Operations Outlook 8.1.5.1 A. ii:

- Outages:
  - SWP: Outages from 6/1/2021 to 6/3/2021.
  - CVP: No outages. Federal Jones Pumping Plant will be operating at 0 cfs to minimize total export facility exports are expected to shift on 6/10/2021 to in the State pumping facilities in an effort to better manage controlling factors.

- Exports: 6/7/2021
  - SWP: 138 cfs
  - CVP: 1,586 cfs
- Meteorological Forecast: *Precipitation, wind, air temperature. Are conditions (i.e. flow, turbidity, water temp) expected to change?* As per the National Weather Service Area Forecast Synopsis on 6/8/2021: *“Cooling trend through Wednesday with below normal temperatures. A few showers or thunderstorms will be possible over the northern mountains today and Wednesday, otherwise dry weather continues.”*
- Meteorology is not expected to result in responses in Delta hydrology.
- Storm Event Projection: Hydrological conditions will not provide an opportunity for a storm flex change in exports that allows for an OMRI more negative than -5,000 cfs.

Section 3-C: Projected Conditions 8.1.5.1 A. iii:

- DCC Gates position: Closed on 12/1/2020 and remained closed through May 2021 (with few exceptions) per Reclamation’s PA DCC gate operations. DCC gates opened on 6/4/2021, then closed on 6/7/2021 per Reclamation’s PA weekend schedule. The DCC gates are expected to remain closed this weekend due to salinity concerns in the Delta.
- Sacramento River flow at Freeport: 5,000 to 6,500 cfs
- San Joaquin River flow at Vernalis: 800 to 1,500 cfs
- QWEST: QWEST was positive at 1,500 cfs, is expected to become slightly negative, and could become slightly positive later in the week as upstream releases reach the Delta.
- Old River at Bacon Island (OBI) Turbidity: *Is turbidity at Bacon Island (OBI) expected to change due to precipitation, wind, operations, or other factors?* Not discussed.
- Freeport Turbidity: *Is turbidity at Freeport (FPT) expected to change due to precipitation, wind, operations, or other factors?* Not discussed.
- Expected changes in South Delta Exports:
  - CCF: 300 to 800 cfs
  - Tracy: 0 to 800 cfs

Beginning 6/10/2021, the SWP will be exporting approximately 450 cfs for the CVP through the Intertie.

- Expected OMRI Values: -1,000 to -1,800 cfs

Table 1: Comparison of OMR gauge and OMR Index.

| Date     | Averaging Period | USGS gauges (cfs) | Index (cfs) |
|----------|------------------|-------------------|-------------|
| 6/5/2021 | Daily            | -2,700            | -1,600      |
| 6/5/2021 | 5-day            | -2,200            | -1,600      |
| 6/5/2021 | 14-day           | -2,200            | -1,500      |
| 6/7/2021 | Daily            | Not Applicable    | -1,600      |
| 6/7/2021 | 5-day            | Not Applicable    | -1,600      |
| 6/7/2021 | 14-day           | Not Applicable    | -1,500      |

## Section 4: Distribution and Biology

### 8.1.5.1.B Assessment of biological information for WR and SR.

#### Section 4-A: WR Population Status 8.1.5.1.B i

- Adult escapement estimate:
  - Estimate from carcass counts for adults contributing to brood year (BY) 2020 is 6,195 natural origin total adults and 4,093 female spawners.
  - Adults that will contribute to BY 2021 have mostly transited the Delta system and are holding and spawning in the Keswick area.
- Redd distribution and fry emergence timing:
  - BY 2020 WR fry emergence is complete for this OMR season. BY 2020 total passage at Red Bluff Diversion Dam through 5/20/2021 is 2,096,219 fish. Mean cumulative weekly passage of WR through May 20 for the last 18 years of passage data is 100.00% with one standard deviation measuring 0.0%.
- Juvenile production estimate:
  - A final JPE has been provided by NMFS and CDFW for BY 2020 which estimates 330,130 natural-origin juvenile WR will reach the Delta. The final JPE also estimates that 97,888 LSNFH WR and 37,232 Battle Creek Jumpstart WR will reach the Delta.
- Livingston Stone National Fish Hatchery release:
  - See Appendix 3 Hatchery Release Data WY 2021 for more information.
- Distribution of natural WR:
  - % of juveniles upstream of the Delta: 0%
  - % of juveniles in Delta: 0-1%
  - % of juveniles past Chipps Island: 99-100%
- Distribution of Livingston Stone National Fish Hatchery Sacramento River WR and Battle Creek WR:
  - % of juveniles upstream of the Delta: 0%
  - % of juveniles in Delta: 0-1%
  - % of juveniles past Chipps Island: 99-100%
- Change in risk of entrainment into the central Delta:
  - See Section 1-A: Sacramento River and Confluence

#### Section 4-B: SR Population Status 8.1.5.1.B ii

- Adult escapement estimate: Not available.
  - First early adults that will contribute to BY 2021 have entered the Delta system are moving upstream and holding upstream in the oversummer habitats.
- Redd distribution and fry emergence timing:
  - Adult SR completed spawning by mid-November.
  - Egg incubation and fry emergence is complete for this season. Juveniles are rearing and migrating.
- Hatchery release (in-river and downstream):
  - See Appendix 3.
- Distribution of natural SR:
  - % of juveniles upstream of the Delta: 0-1%
  - % of juveniles in Delta: 0-1%

- % of juveniles past Chipps Island: 98-100%

- Distribution of Feather River Fish Hatchery SR: See Section 8.1.5.1.C
- Change in risk of entrainment into the central Delta:
  - See Section 1-A: Sacramento River and Confluence

Section 4-C: Additional Data Sources to Assess Sensitivity to Entrainment into the Central and South Delta  
8.1.5.1.C & D

- In-Delta distribution of WR and SR: See Section 4-A: WR population status 8.1.5.1.B i and Section 4-B SR population status 8.1.5.1.B ii.
- Acoustic telemetry: *Summary of acoustic telemetry tracking*
  - Two groups of production LFR were released from CNFH on 1/4/2021 and 1/5/2021. A subset of each group were acoustic tagged, 460 and 141 fish respectively. The first tag detected from the first release group at Tower Bridge occurred five days later (1/9/2021). As of 3/10/2021, 85 fish have been detected at the I-80/50 Bridge with the last arrival detected on 2/3/2021 and 51 have been detected at the Benicia east and west sites with the last arrival detected on 2/7/2021. One fish was detected in Old River at Quimby Island on 1/20/2021. The last detections for this release occurred on 2/7/2021 and the acoustic tag batteries are at the end of their useful lifetime.
  - Six groups of production WR were released from LSNFH on 1/30/2021. A subset of three groups were acoustic tagged; 134, 131, and 291 fish respectively. The first tag detection occurred at I-80/50 Bridge five days after release (2/5/2021). A total of 49 fish were detected at the I-80/50 Bridge with the last detection occurring on 3/29/2021. Fourteen detections have been recorded in Georgiana Slough with the last detections occurring on 3/21/2021. Thirty-five fish have been detected in the in the Sacramento River south of Georgiana Slough with the last detection on 3/24/2021. Twenty fish have been detected at the Benicia Bridge west receiver with the last detection on 3/30/2021. One fish was detected at Old River at Quimby Island on 3/22/2021. Batteries are at the end of their useful lifetime.
  - Three groups of jumpstart WR were released into North Fork Battle Creek on 3/8/2021, 3/10/2021, and 3/18/2021. A subset of each group were acoustic tagged with 300 fish per group. Twenty-seven fish have been detected at the I-80/50 Bridge with the last detection occurring on 4/14/2021. Six detections have been recorded in Georgiana Slough with the last detections occurring on 4/1/2021. Eight detections have been recorded in the Sacramento River south of Georgiana Slough with the last detection occurring on 4/5/2021. Two fish have been detected at the Benicia Bridge west receiver as of 5/8/2021.
  - The first group of FRH SR were released on 3/19/2021 and a subset of 300 fish were acoustic tagged (SR Surrogate Group – FRH Group 1). A second group of FRH SR were released on 4/1/2021 and 290 fish were acoustic tagged (SR Surrogate Group – FRH Group 2). The last fish detected at the I80/50 Bridge was on 4/9/2021 for a total of 157 fish. Fifteen detections have been recorded in Georgiana Slough with the last detection on 4/3/2021. Thirty-six detections have been recorded in the Sacramento River south of the junction of Georgiana Slough with the last detection on 4/10/2021. Thirteen fish have been detected at the Benicia Bridge west receiver with the last detection occurring on 4/14/2021.
  - Two groups of production FR were released from CNFH (SR Surrogate Group – CNFH Group 2) on 3/24/2021 (released upstream at Battle Creek) and 3/26/2021 (released downstream at Butte City). A subset of 300 fish per group were acoustic tagged. Seventy fish have been

detected at the I-80/50 Bridge with the last detection occurring on 4/25/2021. Seven detections have been recorded in Georgiana Slough with the last detections occurring on 4/5/2021. Twenty-eight detections have been recorded in the Sacramento River south of Georgiana Slough with the last detection occurring on 4/22/2021. Fourteen fish have been detected at the Benicia Bridge west receiver as of 4/21/2021.

- Trawls: *List all relevant trawl surveys and brief overview of data. Insert tables, PDFs or other information as attachment at end of document. Include interruptions to sampling or other relevant information (e.g. canceled surveys, dropped stations, etc.)*
  - See Appendix 1: SaMT Monitoring Program Data
- Rotary Screw Traps: *List all relevant rotary screw trap surveys and brief overview of data. Insert tables, PDFs or other information as attachment at end of document. Include interruptions to sampling or other relevant information (e.g. canceled surveys, dropped stations, etc.)*
  - See Appendix 1: SaMT Monitoring Program Data
- Seines: *List all relevant seine surveys and brief overview of data. Insert tables, PDFs or other information as attachment at end of document. Include interruptions to sampling or other relevant information (e.g. canceled surveys, dropped stations, etc.)*
  - See Appendix 1: SaMT Monitoring Program Data
- Additional hatchery release notifications: *List all relevant hatchery release notifications.*
  - See Appendix 3 Hatchery Release Data WY 2021
- New monitoring (as required by Condition of Approval 7.5.1, 7.5.2, and 7.5.3): *Upstream monitoring results during transfer window, additional rotary screw trap monitoring updates, additional acoustic tag study results, genetic identification results, trap capture efficiency trial results, and pathology results if available and relevant*
  - Not applicable at this time.
- Anticipated emigration to continue into the Delta:
  - See Table 3.
- Flows in the Sacramento River predicted with upcoming storm events:
  - See Section 3-A: Water operations conditions 8.1.5.1 A. i, iii and the routing analysis below.
- DCC gate position:
  - Closed 12/1/2020 until further notice due to salinity intrusion (see Section 3-A: Water Operations C 8.1.5.1 A. i, iii for more information).
- Prediction of tidal interaction at Georgiana Slough (*Inflow to Delta from Sacramento River and the interaction of the muting of tidal effects around Georgiana Slough*):
  - See Section 3-A: Water operations conditions 8.1.5.1 A. i, iii and the routing analysis below.
- Precipitation in the forecast for the week and river flows affecting routing into central Delta:
  - See Section 3-B: Water Operations Outlook 8.1.5.1 A. ii: Storm Event Projection.
- Routing analysis:
  - STARS analysis was conducted on 6/6/2021 with results presented in Table 2 below. These results reflect the DCC gate weekend opening schedule for June.



Table 2: STARS Model output.

| Date: 6/6/2021            | DCC       | Georgiana Slough | Sacramento River | Sutter and Steamboat Sloughs |
|---------------------------|-----------|------------------|------------------|------------------------------|
| Proportion of Entrainment | 24%       | 19%              | 32%              | 23%                          |
| Survival                  | 9%        | 13%              | 31%              | 29%                          |
| Travel Time               | 22.5 days | 21.0 days        | 10.5 days        | 10.3 days                    |

- Trend analysis: *Provide brief description of historic trends if relevant (e.g. salvage patterns, onset of spawning, etc.). Refer to data or publications as needed:*

Table 3: Historic migration and salvage patterns for unclipped WR and SR as reported on SacPAS ([http://www.cbr.washington.edu/sacramento/data/query\\_hrt.html](http://www.cbr.washington.edu/sacramento/data/query_hrt.html) and [http://www.cbr.washington.edu/sacramento/data/query\\_salvage\\_hrt.html](http://www.cbr.washington.edu/sacramento/data/query_salvage_hrt.html)) with associated 95% confidence interval. These values are provided for context only.

| Date:<br>6/6/2021 | RBDD RST   | Tisdale<br>RST                                   | Knights Landing<br>RST                           | Sac Trawl  | Chippis<br>Island Trawl                          | Salvage                       |
|-------------------|--|--|--|--|--|-------------------------------|
| WR                | 100.0%<br>(100.0%,<br>100.0%)<br>BY: 2011 - 2019 | 100.0%<br>(100.0%,<br>100.0%)<br>BY: 2011 - 2019 | 100.0%<br>(100.0%,<br>100.0%)<br>BY: 2011 - 2019 | 100.0%<br>(100.0%,<br>100.0%)<br>BY: 2011 - 2019 | 100.0%<br>(100.0%,<br>100.0%)<br>BY: 2011 - 2019 | 100.0%<br>(100.0%,<br>100.0%) |
| SR                | 100.09%<br>(99.9%,<br>100.0%)<br>BY: 2011 - 2019 | 100.0%<br>(100.0%,<br>100.0%)<br>BY: 2011 - 2019 | 100.0%<br>(100.0%,<br>100.0%)<br>BY: 2011 - 2019 | 100.0%<br>(100.0%,<br>100.0%)<br>BY: 2011 - 2019 | 100.0%<br>(100.0%,<br>100.0%)<br>BY: 2011 - 2019 | 99.4%<br>(98.7%,<br>100.1%)   |

- Survival analysis (*e.g. Zeug and Cavallo CWT model*): Not available
- Tillotson entrainment model or other entrainment models as they become available: The WR entrainment tool estimates a median loss of 0 fish and a maximum loss of 0 fish during this week (SacPAS last updated on 6/2/2021).
- Salvage trends in relation to OMRI: *Provide overview of salvage data and insert salvage table as attachment at end of document*: See Appendix 2.
- Future export modifications: *Describe anticipated or potential changes to exports*: Combined exports were 1,100 cfs on 6/8/2021 and are projected to remain steady this week. The following updates are related to agricultural barrier construction:
  - Middle River Barrier construction and in-waterwork started on 5/1/2021. The installation of the culverts on the north abutment was completed on 5/8/2021. The barrier was partially closed and all gates are tied open on 5/12/2021 at 4:45 PM. The barrier was fully closed and all gates are released to tidal operation on 5/15/2021 at 10 AM and all work completed on site on the same day.
  - Mobilization to install the Old River near Tracy Barrier started on 5/8/2021. The in-water work started on 5/10/2021. The boat ramp was completed on 5/22/2021. The barrier was closed on 5/27/2021 at 10:00 AM with one flap gate tied open and the remaining eight operating tidally. The remaining flap gate was released on 6/1/2021 at 3:30 PM. Boat portage is available from 8:00 AM to 6:00 PM Monday through Friday and 7:00 AM to 7:00 PM Saturday and Sunday. Tentative construction completion date is on 6/3/2021 at 5:00PM.
  - Mobilization to install the Grant Line Canal Barrier started on 5/1/2021. The in-water work started on 5/3/2021. The boat ramp was completed on 5/21/2021. The barrier was fully closed on 5/27/2021 at 12:30 PM with one flap gate tied open and the remaining five flap gates operating tidally. The remaining flap gate was released on 6/1/2021 at 10:30 AM. Boat portage is available from 6:00 AM to 8:00 PM every day, including weekends. Construction was completed on 6/2/2021 at 10:00 AM. Construction of the Drought Barrier started on 6/3/2021 and is scheduled to be completed by the end of June.
- Reclamation and DWR submitted a temporary urgency change petition (TUCP) to the SWRCB on 5/17/2021. SWRCB approved the request; therefore, actions to reduce net daily outflow index and

move the western Delta agriculture compliance point upstream began on 6/1/2021. Exports will be

capped during reduced net daily outflow (6/1/2021 – 7/31/2021) to minimum health and safety (1,500 cfs) unless Delta outflow meets D-1641 or during water transfers (after 7/1/2021).

Notes: Salinity intrusion is still a concern even with the relaxed requirements granted by the TUCP.

## Appendix 1: SaMT Monitoring Program Data

Table 4: Fish monitoring data for the 6/8/2021 SaMT meeting. The following table presents fish monitoring data summarized over the past week. Unless otherwise noted, reported sizes are fork length. FR = fall-run, WR = winter-run, SR = spring-run, LFR = late-fall-run

| Location              | GCID RST <sup>1</sup> | Tisdale RST <sup>2</sup> | Knights Landing RST <sup>2</sup> | Beach Seines <sup>3</sup> | Sacramento Trawl <sup>3</sup> | Chippis Is. Midwater Trawl <sup>3</sup> | Mossdale Kodiak Trawl <sup>4</sup> |
|-----------------------|-----------------------|--------------------------|----------------------------------|---------------------------|-------------------------------|---|------------------------------------|
| Sample Date           | N/A                   | N/A                      | N/A                              | 6/2-6/4                   | 6/1-6/4                       | 6/1, 6/3-6/4                            | 6/1, 6/3-6/5                       |
| Juvenile Chinook      |                       |                          |                                  |                           |                               |   |                                    |
| Fall-run Chinook      |                       |                          |                                  | 4                         | 1                             |   |                                    |
| Spring-run Chinook    |                       |                          |                                  |                           |                               |   |                                    |
| Winter-run Chinook    |                       |                          |                                  |                           |                               |   |                                    |
| Late Fall-run Chinook |                       |                          |                                  |                           |                               |   |                                    |
| Chinook (ad-clip)     |                       |                          |                                  | 3                         |                               | 1                                       |                                    |
| Steelhead (wild)      |                       |                          |                                  |                           |                               |   |                                    |
| Steelhead (ad-clip)   |                       |                          |                                  |                           |                               |   |                                    |
| Green Sturgeon        |                       |                          |                                  |                           |                               |   |                                    |
| Flows (avg. cfs)      |                       |                          |                                  | N/A                       | N/A                           | N/A                                     | N/A                                |
| W. Temp. (avg. °F)    |                       |                          |                                  | N/A                       | N/A                           | N/A                                     | N/A                                |
| Turbidity (avg. NTU)  |                       |                          |                                  | N/A                       | N/A                           | N/A                                     | N/A                                |

<sup>1</sup> The GCID RST cone was raised on 5/29 due to excessive amounts of debris and water temperatures approaching 69.8 F.

<sup>2</sup> Tisdale and KL RSTs are not sampling due to water temperatures exceeding the fish handling threshold.

<sup>3</sup> DatCall data reported in the 5/30 – 6/5 DJFMP sampling summary.

<sup>4</sup> Mossdale sampling conducted by CDFW; no salmonid catch last week.

Table 5: Delta sturgeon tagging and monitoring.

| Date     | Comments   |
|----------|--|
| 6/7/2021 | <ul style="list-style-type: none"> <li data-bbox="446 247 1518 357">Juvenile sturgeon tagging and monitoring was not conducted during the week ending 6/5/2021 due to the Memorial Day Holiday and other project priorities. Tagging and monitoring will resume 6/7/2021.</li> </ul> |

GS = green sturgeon, WS = white sturgeon

Table 6: CDFW adult monitoring surveys.

| Location     | American River Carcass Survey | Stanislaus River Carcass Survey |
|--------------|-------------------------------|---------------------------------|
| Sample Dates | Concluded for the season      | Not Sampled                     |





Table 8: Chinook salmon weekly salvage and loss combined for both the SWP and the CVP fish collection facilities between 6/1-6/6/2021. Race is determined by LAD on the date of capture. Hatchery origin fish are determined by the lack of adipose fin. Salvage is equal to the estimated number of fish collected by the CVP and SWP fish protective facilities per unit of time. State Water Project loss is equal to salvage multiplied by 4.33. Central Valley Project loss is equal to salvage multiplied by 0.68. Prepared by Geir Aasen on 6/7/2021. These are preliminary results and are subject to revision.

| Category               | Salvage | Loss | Trend          |
|------------------------|---------|------|----------------|
| Wild winter-run        | 0       | 0    | →              |
| Wild spring-run        | 0       | 0    | →              |
| Wild late Fall-run     | 0       | 0    | →              |
| Wild fall-run          | 0       | 0    | ↘              |
| Weekly Total           | 0       | 0    | Not Applicable |
| Hatchery winter-run    | 0       | 0    | →              |
| Hatchery spring-run    | 0       | 0    | →              |
| Hatchery late Fall-run | 0       | 0    | →              |
| Hatchery fall-run      | 0       | 0    | →              |
| Weekly Total           | 0       | 0    | Not Applicable |

Table 9: Chinook salmon cumulative salvage and loss combined for both the SWP and the CVP fish collection facilities across WY 2021. Race is determined by LAD on the date of capture. Hatchery origin fish are determined by the lack of adipose fin. Salvage is equal to the estimated number of fish collected by the CVP and SWP fish protective facilities per unit of time. State Water Project loss is equal to salvage multiplied by 4.33. Central Valley Project loss is equal to salvage multiplied by 0.68. Prepared by Geir Aasen on 6/7/2021. These are preliminary results and are subject to revision.

| Category               | Cumulative Salvage | Cumulative Loss | Trend          |
|------------------------|--------------------|-----------------|----------------|
| Wild winter-run        | 5                  | 8               | →              |
| Wild spring-run        | 293                | 518             | →              |
| Wild late Fall-run     | 0                  | 0               | →              |
| Wild fall-run          | 322                | 371             | ↘              |
| Season Total           | 620                | 897             | Not Applicable |
| Hatchery winter-run    | 7                  | 16              | →              |
| Hatchery spring-run    | 489                | 967             | →              |
| Hatchery late Fall-run | 52                 | 86              | →              |
| Hatchery fall-run      | 26                 | 81              | →              |
| Season Total           | 574                | 1,151           | Not Applicable |

Table 10: Steelhead weekly salvage and loss combined for both the SWP and the CVP fish collection facilities for 6/1-6/6/2021. Hatchery origin fish are determined by the lack of adipose fin. Salvage is equal to the estimated number of fish collected by the CVP and SWP fish protective facilities per unit of time. State Water Project loss is equal to salvage multiplied by 4.33. Central Valley Project loss is equal to salvage multiplied by 0.68. Prepared by Geir Aasen on 6/7/2021. These are preliminary results and are subject to revision.

| Category           | Salvage | Loss | Trend          |
|--------------------|---------|------|----------------|
| Wild steelhead     | 0       | 0    | →              |
| Hatchery steelhead | 0       | 0    | →              |
| Weekly Total       | 0       | 0    | Not Applicable |

Table 11: Steelhead cumulative salvage and loss combined for both the SWP and the CVP fish collection facilities across WY 2021. Hatchery origin fish are determined by the lack of adipose fin. Salvage is equal to the estimated number of fish collected by the CVP and SWP fish protective facilities per unit of time. State Water Project loss is equal to salvage multiplied by 4.33. Central Valley Project loss is equal to salvage multiplied by 0.68. Prepared by Geir Aasen on 6/7/2021. These are preliminary results and are subject to revision.

| Category           | Cumulative Salvage | Cumulative Loss | Trend          |
|--------------------|--------------------|-----------------|----------------|
| Wild steelhead     | 48                 | 91              | →              |
| Hatchery steelhead | 218                | 342             | →              |
| Season Total       | 266                | 433             | Not Applicable |

Appendix 3: Hatchery Salmon Release Data WY 2021 Table 12. Hatchery salmon release data for Brood Year 2020 and Water Year 2021.

| Release Date | Hatchery | Race      | CWT      | Marked Release Number | Total Release | Percent Marked | Release Location   | Mark                  | Agency | Release Type |
|--------------|----------|-----------|----------|-----------------------|---------------|----------------|--|-----------------------|--------|--------------|
| 12/3/2020    | SCARF    | Spring    | 06-05-22 | 4,593                 | 4,593         | 100%           | San Joaquin River at Highway 140                         | CWT and Ad-clip       | CDFW   | SJRRP        |
| 12/3/2020    | SCARF    | Spring    | 06-19-66 | 501                   | 501           | 100%           | San Joaquin River at Highway 140                         | CWT, Ad-clip, and PIT | CDFW   | SJRRP        |
| 1/4/2021     | CNFH     | Late Fall | 05-63-47 | 67,962                | 67,962        | 100%           | Battle Creek at CNFH                                     | CWT and Ad-clip       | USFWS  | Production   |
| 1/4/2021     | CNFH     | Late Fall | 05-63-48 | 67,016                | 67,016        | 100%           | Battle Creek at CNFH                                     | CWT and Ad-clip       | USFWS  | Production   |
| 1/4/2021     | CNFH     | Late Fall | 05-63-49 | 57,104                | 57,104        | 100%           | Battle Creek at CNFH                                     | CWT and Ad-clip       | USFWS  | Production   |
| 1/4/2021     | CNFH     | Late Fall | 05-63-50 | 62,958                | 62,958        | 100%           | Battle Creek at CNFH                                     | CWT and Ad-clip       | USFWS  | Production   |
| 1/4/2021     | CNFH     | Late Fall | 05-63-51 | 74,516                | 74,516        | 100%           | Battle Creek at CNFH                                     | CWT and Ad-clip       | USFWS  | Production   |
| 1/4/2021     | CNFH     | Late Fall | 05-63-52 | 67,174                | 67,174        | 100%           | Battle Creek at CNFH                                     | CWT and Ad-clip       | USFWS  | Production   |
| 1/4/2021     | CNFH     | Late Fall | 05-63-53 | 67,477                | 67,477        | 100%           | Battle Creek at CNFH                                     | CWT and Ad-clip       | USFWS  | Production   |
| 1/4/2021     | CNFH     | Late Fall | 05-63-54 | 58,824                | 58,824        | 100%           | Battle Creek at CNFH                                     | CWT and Ad-clip       | USFWS  | Production   |
| 1/4/2021     | CNFH     | Late Fall | 05-63-55 | 57,548                | 57,548        | 100%           | Battle Creek at CNFH                                     | CWT and Ad-clip       | USFWS  | Production   |
| 1/4/2021     | CNFH     | Late Fall | 05-63-56 | 52,660                | 52,660        | 100%           | Battle Creek at CNFH                                     | CWT and Ad-clip       | USFWS  | Production   |
| 1/4/2021     | CNFH     | Late Fall | 05-63-57 | 52,555                | 52,555        | 100%           | Battle Creek at CNFH                                     | CWT and Ad-clip       | USFWS  | Production   |
| 1/8/2021     | CNFH     | Late Fall | 05-63-59 | 66,912                | 66,912        | 100%           | Battle Creek at CNFH                                     | CWT and Ad-clip       | USFWS  | Experimental |
| 1/22/2021    | CNFH     | Late Fall | 05-63-60 | 57,357                | 57,357        | 100%           | Battle Creek at CNFH                                     | CWT and Ad-clip       | USFWS  | Experimental |
| 1/26/2021    | SCARF    | Spring    | 06-22-05 | 53,690                | 53,690        | 100%           | San Joaquin River at Highway 140                         | CWT and Ad-clip       | CDFW   | SJRRP        |
| 1/29/2021    | CNFH     | Late Fall | 05-63-58 | 64,807                | 64,807        | 100%           | Battle Creek at CNFH                                     | CWT and Ad-clip       | USFWS  | Experimental |
| 1/30/2021    | LNFH     | Winter    | 05-65-32 | 43,567                | 43,567        | 100%           | Sacramento River at Caldwell Park Boat Ramp, Redding, CA | CWT and Ad-clip       | USFWS  | Production   |
| 1/30/2021    | LNFH     | Winter    | 05-65-33 | 46,697                | 46,697        | 100%           | Sacramento River at Caldwell Park Boat Ramp, Redding, CA | CWT and Ad-clip       | USFWS  | Production   |
| 1/30/2021    | LNFH     | Winter    | 05-65-34 | 46,955                | 46,955        | 100%           | Sacramento River at Caldwell Park Boat Ramp, Redding, CA | CWT and Ad-clip       | USFWS  | Production   |
| 1/30/2021    | LNFH     | Winter    | 05-65-35 | 52,202                | 52,202        | 100%           | Sacramento River at Caldwell Park Boat Ramp, Redding, CA | CWT and Ad-clip       | USFWS  | Production   |

| Release Date | Hatchery | Race   | CWT      | Marked Release Number | Total Release | Percent Marked | Release Location   | Mark                      | Agency | Release Type |
|--------------|----------|--------|----------|-----------------------|---------------|----------------|--|---------------------------|--------|--------------|
| 1/30/2021    | LNFH     | Winter | 05-65-36 | 53,478                | 53,478        | 100%           | Sacramento River at Caldwell Park Boat Ramp, Redding, CA   | CWT and Ad-clip           | USFWS  | Production   |
| 1/30/2021    | LNFH     | Winter | 05-65-37 | 59,267                | 59,267        | 100%           | Sacramento River at Caldwell Park Boat Ramp, Redding, CA   | CWT and Ad-clip           | USFWS  | Production   |
| 2/1/2021     | CNFH     | Winter | 05-58-90 | 53,620                | 53,620        | 100%           | North Fork Battle Creek at Wildcat Road Bridge, Manton, CA | CWT, Ad-clip, left pelvic | USFWS  | Jumpstart    |
| 3/2/2021     | SCARF    | Spring | 06-18-10 | 118,041               | 118,041       | 100%           | San Joaquin River at Highway 140                           | CWT and Ad-clip           | CDFW   | SJRRP        |
| 3/8/2021     | CNFH     | Winter | 05-57-79 | 79,024                | 79,024        | 100%           | North Fork Battle Creek at Wildcat Road Bridge, Manton, CA | CWT, Ad-clip, left pelvic | USFWS  | Jumpstart    |
| 3/10/2021    | CNFH     | Winter | 05-65-39 | 44,105                | 44,105        | 100%           | North Fork Battle Creek at Wildcat Road Bridge, Manton, CA | CWT, Ad-clip, left pelvic | USFWS  | Jumpstart    |
| 3/10/2021    | CNFH     | Fall   | 05-65-42 | 102,854               | 411,417       | 25%            | Battle Creek at CNFH                                       | CWT and Ad-clip           | USFWS  | Production   |
| 3/10/2021    | CNFH     | Fall   | 05-65-43 | 106,001               | 424,003       | 25%            | Battle Creek at CNFH                                       | CWT and Ad-clip           | USFWS  | Production   |
| 3/10/2021    | CNFH     | Fall   | 05-65-46 | 113,683               | 454,730       | 25%            | Battle Creek at CNFH                                       | CWT and Ad-clip           | USFWS  | Production   |
| 3/18/2021    | CNFH     | Fall   | 05-65-44 | 107,840               | 431,360       | 25%            | Battle Creek at CNFH                                       | CWT and Ad-clip           | USFWS  | Production   |
| 3/18/2021    | CNFH     | Fall   | 05-65-45 | 116,458               | 465,830       | 25%            | Battle Creek at CNFH                                       | CWT and Ad-clip           | USFWS  | Production   |
| 3/18/2021    | CNFH     | Fall   | 05-65-47 | 118,099               | 472,395       | 25%            | Battle Creek at CNFH                                       | CWT and Ad-clip           | USFWS  | Production   |
| 3/18/2021    | CNFH     | Fall   | 05-65-48 | 111,097               | 444,386       | 25%            | Battle Creek at CNFH                                       | CWT and Ad-clip           | USFWS  | Production   |
| 3/18/2021    | CNFH     | Fall   | 05-65-49 | 115,494               | 461,977       | 25%            | Battle Creek at CNFH                                       | CWT and Ad-clip           | USFWS  | Production   |
| 3/18/2021    | CNFH     | Fall   | 05-65-50 | 111,699               | 446,796       | 25%            | Battle Creek at CNFH                                       | CWT and Ad-clip           | USFWS  | Production   |
| 3/18/2021    | CNFH     | Fall   | 05-65-51 | 111,702               | 446,808       | 25%            | Battle Creek at CNFH                                       | CWT and Ad-clip           | USFWS  | Production   |
| 3/18/2021    | CNFH     | Fall   | 05-65-52 | 115,210               | 460,839       | 25%            | Battle Creek at CNFH                                       | CWT and Ad-clip           | USFWS  | Production   |
| 3/18/2021    | CNFH     | Fall   | 05-65-53 | 113,573               | 454,293       | 25%            | Battle Creek at CNFH                                       | CWT and Ad-clip           | USFWS  | Production   |
| 3/18/2021    | CNFH     | Fall   | 05-65-54 | 113,865               | 455,459       | 25%            | Battle Creek at CNFH                                       | CWT and Ad-clip           | USFWS  | Production   |
| 3/18/2021    | CNFH     | Fall   | 05-65-55 | 111,418               | 445,670       | 25%            | Battle Creek at CNFH                                       | CWT and Ad-clip           | USFWS  | Production   |
| 3/18/2021    | CNFH     | Winter | 05-65-38 | 37,814                | 37,814        | 100%           | North Fork Battle Creek at Wildcat Road Bridge, Manton, CA | CWT, Ad-clip, left pelvic | USFWS  | Jumpstart    |

| Release Date | Hatchery | Race   | CWT      | Marked Release Number | Total Release | Percent Marked | Release Location                          | Mark            | Agency | Release Type |
|--------------|----------|--------|----------|-----------------------|---------------|----------------|---|-----------------|--------|--------------|
| 3/19/2021    | FRH      | Spring | 06-22-90 | 263,239               | 263,239       | 100%           | Feather River at Boyd's Pump Boat Launch  | CWT and Ad-clip | CDFW   | Production   |
| 3/19/2021    | FRH      | Spring | 06-22-91 | 250,788               | 250,788       | 100%           | Feather River at Boyd's Pump Boat Launch  | CWT and Ad-clip | CDFW   | Production   |
| 3/22/2021    | SCARF    | Spring | 06 23 46 | 1,100                 | 1,100         | 100%           | San Joaquin River at Highway 140          | CWT and Ad-clip | CDFW   | SJRRP        |
| 3/24/2021    | CNFH     | Fall   | 05-65-70 | 92,898                | 92,898        | 100%           | Battle Creek at CNFH                      | CWT and Ad-clip | USFWS  | Experimental |
| 3/24/2021    | CNFH     | Fall   | 05-65-73 | 92,497                | 92,497        | 100%           | Battle Creek at CNFH                      | CWT and Ad-clip | USFWS  | Experimental |
| 3/26/2021    | CHNF     | Fall   | 05-65-71 | 92,262                | 92,262        | 100%           | Sacramento River at Scotty's Landing      | CWT and Ad-clip | USFWS  | Experimental |
| 3/26/2021    | CNFH     | Fall   | 05-65-72 | 94,415                | 94,415        | 100%           | Sacramento River at Scotty's Landing      | CWT and Ad-clip | USFWS  | Experimental |
| 4/1/2021     | FRH      | Spring | 06-22-92 | 250,438               | 250,438       | 100%           | Feather River at Boyd's Pump Boat Launch  | CWT and Ad-clip | CDFW   | Production   |
| 4/1/2021     | FRH      | Spring | 06-22-93 | 249,874               | 249,874       | 100%           | Feather River at Boyd's Pump Boat Launch  | CWT and Ad-clip | CDFW   | Production   |
| 4/6/2021     | SCARF    | Spring | 06 23 46 | 2,200                 | 2,200         | 100%           | San Joaquin River at Highway 140          | CWT and Ad-clip | CDFW   | SJRRP        |
| 4/8/2021     | CNFH     | Fall   | 05 65 56 | 114,149               | 456,594       | 25%            | Battle Creek at CNFH                      | CWT and Ad-clip | USFWS  | Production   |
| 4/8/2021     | CNFH     | Fall   | 05 65 57 | 109,956               | 439,824       | 25%            | Battle Creek at CNFH                      | CWT and Ad-clip | USFWS  | Production   |
| 4/8/2021     | CNFH     | Fall   | 05 65 58 | 109,545               | 438,178       | 25%            | Battle Creek at CNFH                      | CWT and Ad-clip | USFWS  | Production   |
| 4/8/2021     | CNFH     | Fall   | 05 65 59 | 113,658               | 454,633       | 25%            | Battle Creek at CNFH                      | CWT and Ad-clip | USFWS  | Production   |
| 4/8/2021     | CNFH     | Fall   | 05 65 60 | 106,547               | 426,189       | 25%            | Battle Creek at CNFH                      | CWT and Ad-clip | USFWS  | Production   |
| 4/8/2021     | CNFH     | Fall   | 05 65 61 | 118,137               | 472,549       | 25%            | Battle Creek at CNFH                      | CWT and Ad-clip | USFWS  | Production   |
| 4/8/2021     | CNFH     | Fall   | 05 65 62 | 113,515               | 454,060       | 25%            | Battle Creek at CNFH                      | CWT and Ad-clip | USFWS  | Production   |
| 4/8/2021     | CNFH     | Fall   | 05 65 63 | 103,911               | 415,643       | 25%            | Battle Creek at CNFH                      | CWT and Ad-clip | USFWS  | Production   |
| 4/8/2021     | CNFH     | Fall   | 05 65 64 | 121,400               | 485,598       | 25%            | Battle Creek at CNFH                      | CWT and Ad-clip | USFWS  | Production   |
| 4/8/2021     | CNFH     | Fall   | 05 65 65 | 103,862               | 415,449       | 25%            | Battle Creek at CNFH                      | CWT and Ad-clip | USFWS  | Production   |
| 4/8/2021     | CNFH     | Fall   | 05 65 66 | 113,700               | 454,798       | 25%            | Battle Creek at CNFH                      | CWT and Ad-clip | USFWS  | Production   |
| 4/8/2021     | CNFH     | Fall   | 05 65 67 | 119,085               | 476,341       | 25%            | Battle Creek at CNFH                      | CWT and Ad-clip | USFWS  | Production   |
| 4/16/2021    | MOK      | Fall   | 06 23 50 | 112,500               | 450,000       | 25%            | San Joaquin River Sherman Island Net Pens | CWT and Ad-clip | CDFW   | Production   |
| 4/18/2021    | FRH      | Fall   | 06 23 43 | 245,937               | 985,173       | 25%            | Fort Baker San Francisco                  | CWT and Ad-clip | CDFW   | Production   |

|           |     |      |          |         |         |     |                              |                 |      |            |
|-----------|-----|------|----------|---------|---------|-----|------------------------------|-----------------|------|------------|
| 4/20/2021 | NIM | Fall | 06 15 36 | 167,120 | 669,005 | 25% | Mare Island San Pablo<br>Bay | CWT and Ad-clip | CDFW | Production |
|-----------|-----|------|----------|---------|---------|-----|------------------------------|-----------------|------|------------|

| Release Date | Hatchery | Race | CWT      | Marked Release Number | Total Release | Percent Marked | Release Location                             | Mark            | Agency | Release Type |
|--------------|----------|------|----------|-----------------------|---------------|----------------|--|-----------------|--------|--------------|
| 4/23/2021    | MER      | Fall | 06 15 74 | 75,436                | 266,000       | 28%            | San Joaquin River<br>Sherman Island Net Pens | CWT and Ad-clip | CDFW   | Production   |
| 4/24/2021    | MOK      | Fall | 06 23 51 | 110,000               | 440,000       | 25%            | San Joaquin River<br>Sherman Island Net Pens | CWT and Ad-clip | CDFW   | Production   |
| 4/28/2021    | FRH      | Fall | 06 23 44 | 255,846               | 1,024,494     | 25%            | Conoco Pier 66 San<br>Pablo Bay              | CWT and Ad-clip | CDFW   | Production   |
| 4/29/2021    | NIM      | Fall | 06 22 75 | 35,624                | 142,566       | 25%            | Conoco San Pablo Bay                         | CWT and Ad-clip | CDFW   | Production   |
| 4/29/2021    | NIM      | Fall | 06 23 62 | 132,110               | 528,661       | 25%            | Conoco San Pablo Bay                         | CWT and Ad-clip | CDFW   | Production   |
| 5/1/2021     | MOK      | Fall | 06 23 52 | 111,250               | 445,000       | 25%            | San Joaquin River<br>Sherman Island Net Pens | CWT and Ad-clip | CDFW   | Production   |
| 5/2/2021     | MOK      | Fall | 06 23 53 | 111,250               | 445,000       | 25%            | San Joaquin River<br>Sherman Island Net Pens | CWT and Ad-clip | CDFW   | Production   |
| 5/3/2021     | FRH      | Fall | 06 23 45 | 262,644               | 1,051,803     | 25%            | Point San Quentin San<br>Francisco Bay       | CWT and Ad-clip | CDFW   | Production   |
| 5/4/2021     | MOK      | Fall | 06 23 59 | 120,000               | 480,000       | 25%            | San Francisco at Fort<br>Baker               | CWT and Ad-clip | CDFW   | Production   |
| 5/3-5/4/2021 | CNFH     | Fall | 05 65 68 | 112,125               | 448,499       | 25%            | Marin Rod and Gun Club<br>San Francisco Bay  | CWT and Ad-clip | USFWS  | Production   |
| 5/6/2021     | FRH      | Fall | 06 22 94 | 83,700                | 335,637       | 25%            | Mare Island San Pablo<br>Bay                 | CWT and Ad-clip | CDFW   | Production   |
| 5/6/2021     | FRH      | Fall | 06 22 95 | 86,172                | 345,000       | 25%            | Mare Island San Pablo<br>Bay                 | CWT and Ad-clip | CDFW   | Production   |
| 5/7/2021     | FRH      | Fall | 06 22 96 | 85,935                | 344,055       | 25%            | Mare Island San Pablo<br>Bay                 | CWT and Ad-clip | CDFW   | Production   |
| 5/7/2021     | FRH      | Fall | 06 22 97 | 86,461                | 346,207       | 25%            | Mare Island San Pablo<br>Bay                 | CWT and Ad-clip | CDFW   | Production   |
| 5/8/2021     | MOK      | Fall | 06-23-54 | 111,250               | 445,000       | 25%            | San Joaquin River<br>Sherman Island Net Pens | CWT and Ad-clip | CDFW   | Production   |
| 5/9/2021     | MOK      | Fall | 06 23 55 | 112,500               | 450,000       | 25%            | San Joaquin River<br>Sherman Island Net Pens | CWT and Ad-clip | CDFW   | Production   |
| 5/11/2021    | NIM      | Fall | 06 04 61 | 167,750               | 671,408       | 25%            | Mare Island San Pablo<br>Bay                 | CWT and Ad-clip | CDFW   | Production   |
| 5/12/2021    | FRH      | Fall | 06 22 98 | 85,982                | 344,237       | 25%            | Mare Island San Pablo<br>Bay                 | CWT and Ad-clip | CDFW   | Production   |
| 5/12/2021    | FRH      | Fall | 06 22 99 | 85,553                | 342,635       | 25%            | Mare Island San Pablo<br>Bay                 | CWT and Ad-clip | CDFW   | Production   |
| 5/13/2021    | FRH      | Fall | 06 23 42 | 86,643                | 346,959       | 25%            | Conoco San Pablo Bay                         | CWT and Ad-clip | CDFW   | Production   |

|           |     |      |          |        |         |     |                      |                 |      |            |
|-----------|-----|------|----------|--------|---------|-----|----------------------|-----------------|------|------------|
| 5/13/2021 | FRH | Fall | 06 23 41 | 86,472 | 346,197 | 25% | Conoco San Pablo Bay | CWT and Ad-clip | CDFW | Production |
|-----------|-----|------|----------|--------|---------|-----|----------------------|-----------------|------|------------|



| Release Date     | Hatchery | Race | CWT      | Marked Release Number | Total Release | Percent Marked | Release Location                          | Mark            | Agency | Release Type |
|------------------|----------|------|----------|-----------------------|---------------|----------------|---|-----------------|--------|--------------|
| 5/15/2021        | MOK      | Fall | 06 23 56 | 112,500               | 450,000       | 25%            | San Joaquin River Sherman Island Net Pens | CWT and Ad-clip | CDFW   | Production   |
| 5/16/2021        | NIM      | Fall | 06 23 63 | 134,612               | 538,582       | 25%            | Point San Quentin San Francisco Bay       | CWT and Ad-clip | CDFW   | Production   |
| 5/16/2021        | MOK      | Fall | 06 23 57 | 112,500               | 450,000       | 25%            | San Joaquin River Sherman Island Net Pens | CWT and Ad-clip | CDFW   | Production   |
| 5/16/2021        | NIM      | Fall | 06 23 74 | 35,484                | 141,964       | 25%            | Point San Quentin San Francisco Bay       | CWT and Ad-clip | CDFW   | Production   |
| 5/17 – 5/19/2021 | CNFH     | Fall | 05 65 69 | 110,226               | 440,902       | 25%            | Marin Rod and Gun Club San Francisco Bay  | CWT and Ad-clip | USFWS  | Production   |
| 5/17/2021        | NIM      | Fall | 06 15 75 | 169,849               | 679,819       | 25%            | Fort Baker San Francisco                  | CWT and Ad-clip | CDFW   | Production   |
| 5/18/2021        | MOK      | Fall | 06 23 60 | 121,250               | 485,000       | 25%            | Fort Baker San Francisco                  | CWT and Ad-clip | CDFW   | Production   |
| 5/21/2021        | FRH      | Fall | 06 23 42 | 86,643                | 346,959       | 25%            | Mare Island San Pablo Bay                 | CWT and Ad-clip | CDFW   | Production   |
| 5/21/2021        | FRH      | Fall | 06 23 71 | 17,156                | 68,687        | 25%            | Mare Island San Pablo Bay                 | CWT and Ad-clip | CDFW   | Production   |
| 5/21/2021        | FRH      | Fall | 06 23 76 | 30,150                | 122,233       | 25%            | Mare Island San Pablo Bay                 | CWT and Ad-clip | CDFW   | Production   |
| 5/23/2021        | MOK      | Fall | 06 23 58 | 62,500                | 250,000       | 25%            | Pillar Point Harbor                       | CWT and Ad-clip | CDFW   | Production   |
| 5/25/2021        | MOK      | Fall | 06 15 81 | 160,000               | 160,000       | 100%           | Monterey Bay Santa Cruz Municipal Wharf   | CWT and Ad-clip | CDFW   | Production   |
| 5/25/2021        | NIM      | Fall | 06 20 94 | 34,484                | 138,211       | 25%            | Mare Island San Pablo Bay                 | CWT and Ad-clip | CDFW   | Production   |
| 5/25/2021        | NIM      | Fall | 06 23 64 | 140,457               | 562,996       | 25%            | Mare Island San Pablo Bay                 | CWT and Ad-clip | CDFW   | Production   |
| 5/26/2021        | MOK      | Fall | 06 15 80 | 160,000               | 160,000       | 100%           | Monterey Bay Monterey Municipal Wharf     | CWT and Ad-clip | CDFW   | Production   |
| 5/29/2021        | MOK      | Fall | 06 23 58 | 62,500                | 250,000       | 25%            | Pillar Point Harbor                       | CWT and Ad-clip | CDFW   | Production   |
| 6/1/2021         | MOK      | Fall | 06 15 44 | 123,750               | 495,000       | 25%            | Fort Baker San Francisco                  | CWT and Ad-clip | CDFW   | Production   |
| 6/3/2021         | MOK      | Fall | 06 23 61 | 127,000               | 507,411       | 25%            | Fort Baker San Francisco                  | CWT and Ad-clip | CDFW   | Production   |
| 6/3/2021         | MOK      | Fall | 06 82 07 | 2,400                 | 9,589         | 25%            | Fort Baker San Francisco                  | CWT and Ad-clip | CDFW   | Production   |
| 6/5/2021         | MOK      | Fall | 06 23 58 | 62,500                | 250,000       | 25%            | Pillar Point Harbor                       | CWT and Ad-clip | CDFW   | Production   |

Appendix 4: COA Spring-run Chinook Hatchery Surrogate Summary Table, WY 2021.

| Hatchery                       | Release Group | Date                            | Race | Total Fish Released  | CWT Fish           | Tag Codes         | Loss Threshold |
|--------------------------------|---------------|---------------------------------|------|----------------------|--------------------|-------------------|----------------|
| Coleman National Fish Hatchery | Group 1       | 3/10/2021                       | FR   | 1,290,150            | 322,538            | 05 65 42          | 806.35         |
|                                |               |                                 |      |                      |                    | 05 65 43          |                |
|                                |               |                                 |      |                      |                    | 05 65 46          |                |
|                                | Group 2       | 3/24/2021<br>3/26/2021          | FR   | 372,072              | 372,072            | 05 65 70          | 930.18         |
|                                |               |                                 |      |                      |                    | 05 65 71          |                |
|                                |               |                                 |      |                      |                    | 05 65 72          |                |
|                                | Group 3*      | 4/8/2021                        | FR   | 5,389,856            | 1,347,456          | 05 65 73          | 3,368.66       |
|                                |               |                                 |      |                      |                    | 05 65 56          |                |
|                                |               |                                 |      |                      |                    | 05 65 57          |                |
|                                |               |                                 |      |                      |                    | 05 65 58          |                |
|                                |               |                                 |      |                      |                    | 05 65 59          |                |
|                                |               |                                 |      |                      |                    | 05 65 60          |                |
|                                |               |                                 |      |                      |                    | 05 65 61          |                |
|                                |               |                                 |      |                      |                    | 05 65 62          |                |
| 05 65 63                       |               |                                 |      |                      |                    |                   |                |
| Feather River Fish Hatchery    | Group 1       | 3/19/2021                       | SR   | 514,027              | 514,027            | 06 22 90          | 1285.07        |
|                                |               |                                 |      |                      |                    | 06 22 91          |                |
|                                | Group 2       | 4/1/2021                        | SR   | 500,312              | 500,312            | 06 22 92          | 1,250.78       |
|                                |               |                                 |      |                      |                    | 06 22 93          |                |
| Nimbus Fish Hatchery           | Group 1       | <del>Pending - late April</del> | FR   | <del>1,600,000</del> | <del>400,000</del> | N/A - BAY RELEASE |                |
|                                | Group 2       | <del>Pending - early May</del>  | FR   | <del>800,000</del>   | <del>200,000</del> | N/A - BAY RELEASE |                |

\*Coleman National Fish Hatchery Group 3 was utilized as a substitute for Nimbus Fish Hatchery Groups 1 and 2.