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WY 2022 Salmonid and Green Sturgeon Incidental Take and Monitoring Report

Dear Ms. Marcinkevage:

Enclosed is the Water Year 2022 *Salmonid and Green Sturgeon Incidental Take and Monitoring Annual Report*. This annual report is required under the Terms and Conditions of the 2019 National Marine Fisheries Service (NMFS) Biological Opinion and Conference Opinion on the Proposed Long-Term Operations of the Central Valley Project and State Water Project (2019 NMFS Biological Opinion). The enclosed report includes the following:

1. A summary of the incidental take of natural and hatchery winter-run Chinook salmon (*Oncorhynchus tshawytscha*), spring-run Chinook salmon (*O. tshawytscha*) surrogates, Central Valley steelhead (*O. mykiss*), and green sturgeon (*Acipenser medirostris*) at the State Water Project's John E. Skinner Delta Fish Protective Facility and the Central Valley Project's Tracy Fish Collection Facility.
2. A summary of the data acquired through the salmonid monitoring program for the lower Sacramento River and the Delta, along with a summary of the Delta hydrologic conditions.

If you have any questions regarding the report, please contact me at (916) 376-9700 or your staff may contact Farida Islam of the Division of Integrated Science and Engineering, Regulatory Compliance Branch at (916) 376-9817.

Sincerely,

Dean F. Messer

Dean F. Messer, Manager
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WY 2022
SALMONID AND GREEN STURGEON
INCIDENTAL TAKE AND MONITORING REPORT

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WY 2022 SALMONID AND GREEN STURGEON INCIDENTAL TAKE AND MONITORING REPORT

This annual report is required under the Terms and Conditions of the 2019 National Marine Fisheries Service (NMFS) Biological Opinion (BiOp) and Conference Opinion on the Proposed Long-Term Operations (LTO) of the Central Valley Project (CVP) and State Water Project (SWP) (2019 NMFS Biological Opinion). This report summarizes the incidental take of Winter-run Chinook Salmon (*Oncorhynchus tshawytscha*), Spring-run Chinook Salmon (*O. tshawytscha*) surrogates, Central Valley steelhead (*O. mykiss*), and green sturgeon (*Acipenser medirostris*) at the SWP's John E. Skinner Delta Fish Protective Facility and the CVP's Tracy Fish Collection Facility (Delta fish facilities) for Water Year 2022. This report also includes data from a wide geographic area including the salmonid monitoring projects for the lower Sacramento River and the Delta (Figure 1), and the hydrologic conditions in the Delta.

The United States Bureau of Reclamation (USBR) consulted under the Endangered Species Act (ESA) with the United States Fish and Wildlife Service (USFWS) and NMFS on potential effects of the Proposed Action (PA) of the Projects on threatened and endangered species. USBR submitted to these agencies a Biological Assessment (BA) on January 31, 2019, describing the proposed action that would be taken and the resulting effects. Reclamation updated the PA during consultation (two updates were provided on April 19, 2019, and July 30, 2019) and provided the final BA on October 21, 2019, which included the final PA description. In turn, the USFWS and NMFS issued their BiOps of the PA on October 21, 2019. Reclamation signed the Record of Decision (ROD), which included the 2019 BiOps from USFWS and NMFS, and began implementing the PA on February 18, 2020.

The Department of Water Resources' (DWR) Incidental Take Permit (ITP) from the California Department of Fish and Wildlife (CDFW) was signed on March 31, 2020 and resulted in a combination of operational requirements, from both the 2019 BiOps and the 2020 ITP, for the SWP. Information regarding Old and Middle River Flow can also be found in Reclamation's Water Year 2022 Seasonal Report for Old and Middle River (OMR) Flow Management (https://www.usbr.gov/mp/bdo/pro-activities-docs.html).

In addition to these annual reports, DWR also actively participated in the Fish and Water Operation stakeholder call and Delta Monitoring Workgroup meetings conducted by USBR and reported the relevant data updates to the Salmon Monitoring Team (SaMT) during the WY 2022 incidental take season. Preliminary analysis of the weekly data reports for SaMT meeting notes are posted on SaMT Websites: https://www.usbr.gov/mp/bdo/salmon-monitoring-team.html

Fish monitoring data were reviewed from the Central Valley Prediction and Assessment of Salmon (SacPAS) website: http://www.cbr.washington.edu/sacramento.

Additionally, fish monitoring data was also received via email distribution from various state and federal distribution lists and other websites.

Data Acquisition

DWR acquired data from the CDFW, USFWS, and other internal DWR and Reclamation divisions. Fisheries monitoring and associated environmental field data collection was interrupted in WY 2022 due to repeated air quality and ongoing sampling disruptions. These resulted primarily from air quality advisories and warnings from large scale forest fires. Core sampling stations, ones critical to indices and operational triggers, were continued to the greatest degree possible.

Methods for Measuring Incidental Take

Similar to previous years, the CVP and SWP followed currently approved and agreed upon Loss Equations (CDFW 2013, https://wildlife.ca.gov/Conservation/Delta/Salvage-Monitoring). The loss equations followed at both fish facilities remained unchanged through the transition to 2019 BiOps from 2009 BiOps. However, per the requirement of 2019 BiOps, DWR continued refinement and improvement of an alternative loss equation tool using data collected during mark-recapture-based field studies including the Skinner Evaluations/Improvements Study (SEIS) and the SWP Delta Fish Facilities Performance Evaluation (DFPE) during WY 2022 water year. This alternative loss equation, first developed in response to Term and Condition 2a of the 2009 NMFS Biological Opinion, uses probability distributions based on field evaluations for model parameters and uses a Bayesian approach to estimate loss when salvage is zero; both of which were recommendations of the BiOp Independent Review Panel. A new task order was developed to review and troubleshoot the developed tool in late May of 2022. In late November of 2022 DWR was updated on the tool but we are still awaiting the final written description on it from the consultants.

Observed Chinook Salmon Salvage

Figure 2 describes the observed Chinook Salmon salvage at the Delta fish facilities in WY 2022 from normal salvage counts, special studies, and secondary flushes. Juvenile Chinook Salmon run type was determined using the Delta length-at-date criteria (LAD) (https://water.ca.gov/LegacyFiles/aes/docs/ValidatingLength-at-DateRunassignments.pdf). Fork lengths were obtained for all Chinook Salmon salvaged at the SWP Delta fish facilities. For the WY 2022 water year, the total juvenile Chinook Salmon catch was 243 fish, expanded salvage was 703 fish, and an expanded combined loss of 1234.16 fish. No sub-adults of an undetermined run of Chinook Salmon were observed that fell outside of the length-at-date criteria (greater than 300 mm fork length) at either facility. Therefore, no loss has occurred for sub-adult Chinook Salmon for the WY 2022.

Based on clarifications made by the Delta Operations for Salmonids and Sturgeon advisory team (DOSS, 2013), DWR and Reclamation defined naturally-produced older juvenile Chinook Salmon as all Chinook Salmon with non-clipped adipose fins (non-clipped) greater than or equal to the minimum Winter-run LAD criteria using the Delta Model, and less than the maximum LAD criteria in the Delta Model. The Delta Model LAD criteria categorizes two different brood years of Winter-run Chinook Salmon in July, and for that month DWR and Reclamation used the minimum Winter-run LAD criteria for the older brood year.

The total number of expanded salvage for non-clipped older juvenile Chinook Salmon in WY 2022 was 41, which was higher than previous year's, total expanded salvage of 5. However, it was lower compared to a total of expanded salvage in WY 2020. The expanded salvage observed in WY 2019, was total of 187. Interestingly, the observed number during WY 2019 was higher than in WY 2018 but since then the total number of salvage has been declining in each water year until WY 2022. Similar to observations in previous years, there was no noticeable correlation between the number of non-clipped older juvenile salvage and export levels (Figure 3).

The overall number of observed hatchery Chinook Salmon at the Delta fish facilities was significantly lower in the WY 2022 water year than the previous year. In WY 2022, the highest number of hatchery Chinook Salmon observed at the Delta fish facilities were from Coleman National Fish Hatchery Late-Fall run group (Figure 2). It was different than previous two years (WY 21 and WY 20) when the number of observed Spring-run Chinook Salmon from the San Joaquin River Restoration Program (SJRRP) comprised the highest proportion of hatchery fish observed in salvage among all of the hatchery release groups. This trend was observed in both the WY 2018 and WY 2017 water years.

Winter-run Chinook Salmon

Winter-run Chinook Salmon Incidental Take

NMFS provided Reclamation with the 2022 Juvenile Production Estimate (JPE) pursuant to the 2019 Biological Opinion on the long-term operations of the Central Valley Project (CVP) and the State Water Project (SWP) (Marcinkevage, 2022). The JPE is calculated each year to determine the authorized level of incidental take for Winter-run Chinook Salmon, under section 7 of the Endangered Species Act (ESA), while operating the CVP/SWP Delta pumping facilities in each water year (NMFS 2019). In 2021, CDFW estimated a total adult escapement 10,269 Winter-run spawners to the upper Sacramento River, which is much higher than the previous year (6,195) and significantly higher than the returns estimated in 2018 (2,458), but the JPE value was

significantly lower than previous years due to a decrease in the egg-to-fry survival estimate (Marcinkevage, 2022). The methodology used in 2021 to calculate the annual Winter-run escapement (Cormack-Jolly-Seber Model) was the same as was used in 2020. The Cormack-Jolly-Seber model allowed for an estimation of a 90% confidence interval, which ranged from 9,280 to 11,258 fish. Based on the point estimate of escapement, NMFS calculated the JPE of natural (non-clipped) Winter-run Chinook Salmon entering the Delta in WY 2022. NMFS took into consideration the recommendations of the Independent Review Panel (IRP) and the advice of the Winter-run Project Work Team (WRPWT) in calculating the number from the Winter-run 2021 brood year. Similar to last year, the WRPWT identified several factors (more detail available in the JPE letter referenced below) in calculating the JPE. Using those factors, the WRPWT presented two different methods to calculate JPE for WY 2022. They advised continuing or updating those factors also for BY 2022. Similar to previous years (since 2014), the group preferred the Juvenile Production Index (JPI) method as it gives a more accurate estimation of the egg-to-fry survival rate based on environmental factors which is an important factor in calculating the JPE. It is noteworthy to mention that similar to the previous year, the team has shared that one of the reasons to choose this particular method in WY 2022 year was also the fact that this method includes a somewhat lower than average egg-to-fry survival rate, which may be a concern due to the continual observance of thiamine deficiency in chinook salmon (Marcinkevage, 2022). According to the 2022 JPE letter, NMFS recommended the continuation of funding for acoustic tag studies on Winter-run for BY 2022 and beyond to provide data on survival rates for various hydrologic condition types.

For Water Year 2021, NMFS estimated that 125,038 natural-origin juvenile Winter-run Chinook Salmon would enter the Delta. Based on this JPE, the incidental take level from October 1, 2021, through June 30, 2022, for single year loss at the Delta fish facilities was 2,501 non-clipped Winter-run Chinook Salmon, which is equal to 2% of the natural Winter-run production entering the Delta. Reclamation's 2019 Proposed Action currently does not include an option for Winter-run take estimates identified by their DNA. Winter-run Chinook Salmon are identified solely based on the Delta LAD Model. Under Reclamation's 2019 Proposed Action and the DWR Incidental Take Limit, the Winter-run single year loss threshold is equal to the loss of 1.17% of the JPE of any single year. A 1.17% loss of the BY2021 winter-run Chinook Salmon is 1,463. Incidental take is based on loss using the current loss equation from CDFW (2013).

More detailed information on rationales provided by NMFS for water year WY 2022 JPE estimation can be found at:
https://www.fisheries.noaa.gov/west-coast/endangered-species-conservation/california-central-valley-water-operations-biological

A low level of loss of wild Winter-run Chinook Salmon, based on the Delta Model LAD criteria, occurred at both Delta fish facilities. At the CVP, loss was 20.56 fish and at the SWP, loss was 52.48 fish. For the previous sampling year, WY 2021, the loss at the

CVP was 3.88 fish and the loss at the SWP was 4.33 fish. The combined expanded loss of Winter-run sized Chinook Salmon was 73.04 fish in WY 2022 season which was 4.99% of the permitted incidental take based on the Reclamation's 2019 Proposed Action. Overall, the combined annual Winter-run sized Chinook Salmon loss, based on LAD criteria, was higher compared to the very low number of total expanded loss equal to 8.21 fish that was estimated in the previous water year. The lowest percentage permitted take in the past ten water years occurred in Water Year WY 2021 (Figure 4).

Under 4.10.5.10.2 of Reclamation's 2019 Proposed Action, DWR and Reclamation propose to avoid exceeding cumulative loss thresholds over the duration of the 2019 BiOps. Cumulative loss thresholds were set based on cumulative historical loss (2010 - 2018). The total cumulative loss of natural-origin Winter-run as of WY 2022 is 264.2 fish which is 3.0% of the cumulative loss threshold (8,738) set in the 2019 PA. LAD loss of natural-origin Winter-run Chinook Salmon was 2.81% of the single-year loss threshold set in the 2019 PA and 10.0% of 50% of the single-year loss threshold set in the 2019 PA. Between October 2021 and June 2022, neither natural-origin Winter-run loss thresholds, single-year or cumulative, were exceeded.

Genetic Run Identification

Genetic samples were obtained from juvenile salmonids, in the form of 1-2mm caudal fin clip, at the CVP and SWP fish protection facilities. At the CVP the protocol was to take a sample from all salvaged juvenile salmonids. At the SWP the protocol was to sample all juvenile salmonids greater than 35mm in fork length.

Observed Winter-run Chinook Salmon Genetic Run Assignment

A total of 129 Chinook samples were salvaged from the CVP and all were sampled and delivered to the genetic laboratory during the WY 2022 water year. Of the 129 CVP samples processed, 96 were assigned genotypes. A total of 114 non-clipped juvenile Chinook was salvaged from the SWP and 113 were sampled and delivered to the genetic laboratory during the WY 2022 water year. Of those 113 SWP samples, 103 were assigned genotypes.

No genetically confirmed juvenile Winter-run Chinook Salmon were observed at the CVP and SWP in WY 2022. However, 2 samples, a 136mm juvenile Chinook sampled at the CVP on 1/28/2022 and a 184mm juvenile Chinook sampled at the SWP on 4/27/2022 were classified as Winter-run by LAD criteria and these samples failed to provide viable results.

Hatchery Winter-run Chinook Salmon Incidental Take

During early February and early March 2022, an estimated 537,771 juvenile Winter-run

(BY2021) from Livingston Stone National Fish Hatchery (LSNFH) were released into the Sacramento River at Caldwell Park near Redding, California, which was higher than the release group of 302,166 hatchery Winter-run during the previous year (BY2020). Based on preliminary release information, NMFS estimated that 151,544 hatchery fish would enter the Delta with an incidental take level of 1,212 fish on a three-year rolling average loss and 1,515 fish for single year loss. Additionally, on March 18, 2021, an estimated total of 136,958 juvenile Winter-run Chinook Salmon were released into Battle Creek. NMFS estimated 7,311 of those fish will survive to enter the Delta during WY 2022. The 2022 Incidental Take Permit limit did not experience a loss greater than 0.12% of the JPE, or 1,515 hatchery produced juvenile Winter-run Chinook Salmon for Winter-run released in the Sacramento River. The WY 2022 Incidental Take Permit limit was a loss no greater than 0.12% of the JPE, or 73 hatchery produced juvenile Winter-run Chinook Salmon for Winter-run released in Battle Creek. The WY 2022 battle creek hatchery Winter-run take level was higher than the take limit of 45 for the year WY 2021. There was a combined loss of 6.70 from the LSNFH hatchery Winter-run Chinook Salmon at the Delta fish facilities and no loss occurred from the additional Battle Creek release group. Therefore, no loss triggers were exceeded for these groups.

Coded Wire Tagged (CWT) fish have been used for many years for investigating the fish behavior and survival rate of Chinook Salmon following release from a hatchery. CWT fish that are identified during salvage at the Delta Fish Facilities (SWP and CVP) are carefully recovered and handled, in accordance with the Standard Operations Protocol, so that the tags can be removed and read. On occasion, tag loss or damage does occur, and some tags are unreadable due to tag imperfections. On these occasions, the fork lengths of the CWT fish are recorded, and the loss is calculated and recorded under the ‘Unknown’ category. For the WY 2022 year, a loss of 66.18 fish was estimated at the CVP as Unknown and reported as ‘Unknown CWT Loss’ (Table 2). At the SWP, the Unknown loss for WY 2022 was estimated at 25.98 fish (Table 2). The combined Unknown loss of 92.16 at both facilities for the WY 2022 season is noted as total (Table 2).

Spring-Run Chinook Salmon

Under the 2019 NMFS Biological Opinions, NMFS uses hatchery-produced subyearling Late Fall-run Chinook Salmon as surrogates for naturally produced yearling Spring-run Chinook Salmon emigrating from the upper Sacramento River and tributaries into the Delta. According to NMFS, these late Fall-run Chinook Salmon are used as surrogates because they are generally released and begin their smoltification and emigration and passage through the Delta at approximately the same time, and at a similar size, as wild yearling Spring-run Chinook Salmon. The Coleman National Fish Hatchery (CNFH) releases a percentage of the total CNFH Late Fall-run Chinook Salmon production as these surrogate release groups.

In WY 2022, CNFH released three groups of Late Fall-run Chinook Salmon marked with unique CWT codes as Spring-run Chinook Salmon surrogates into Battle Creek: 1) 84,343 on 12/15/2021, 2) 82,626 on 12/22/2021, and 3) 77,325 on 1/6/2022 (Table 3). Prior to these releases, the hatchery staff has contacted the SaMT for guidance on the release timing. It was scheduled following similar strategies of coinciding with possible rainfall events. The timing of the release for WY 2022 was different than WY 2021 as the releases occurred later than the usual December release dates to coincide with a possible early January precipitation event for WY 2022. As before, SAMT provided guidance that the first surrogate release should occur about 3 days after the production release and should coincide with a rainfall event. SAMT provided the guidance to release the second surrogate group during January, at least a week after the previous surrogate group and ideally preceding a precipitation event, and to release the third surrogate group after a similar number of days between the first and second releases.

Measuring Incidental Take

The incidental take level for the combined operation of the Delta pumping plants is equal to 0.5% of any individual CNFH Late-Fall Chinook Salmon surrogate release group. Measurement of incidental take for each surrogate release group is based on loss using the current loss equation from DFW (2013). However, there are occasions when the hatchery of origin for the CWT Chinook Salmon could not be confirmed due to lost, missing, or damaged tags, or due to the accidental release of CWT fish during salvage. For this reason, the actual loss could be higher than what is confirmed in Table 2. For the WY 2022 season, the total Unknown loss due to Damaged Tags or Tags Not Found was 92.16 fish (Table 2). As mentioned previously, the Unknown loss is for the entire season and was not necessarily correlated with any specific released group.

First Surrogate Release Group and Incidental Take

The first Spring-run Chinook Salmon surrogate hatchery group of 84,343 CNFH Late Fall-run Chinook Salmon was released on December 15, 2021. The total estimated confirmed loss was 48.61 from this group of fish salvaged at the Delta fish facilities. The percent loss was calculated to be 0.058% of the released group, which was below the exceedance level 0.5% of the release group (Table 3).

Second Surrogate Release Group and Incidental Take

On December 22, 2021, CNFH released the second Spring-run Chinook Salmon surrogate hatchery group of approximately 82,626 Late Fall-run Chinook Salmon into Battle Creek. The confirmed loss from this group was 17.62 fish. The percent loss was calculated to be 0.021% of the released group, which was below the exceedance level 0.5% of the release group (Table 3).

Third Surrogate Release Group and Incidental Take

On January 6, 2022, CNFH released the third Spring-run Chinook Salmon surrogate hatchery group of approximately 77,325 Late Fall-run Chinook Salmon into Battle Creek. The confirmed loss from this group was 20.04 fish. The percent loss was calculated to be 0.026% of the released group, which was below the exceedance level 0.5% of the release group (Table 3).

Fry/Smolt Chinook Salmon Loss

Fry/Smolt Chinook Salmon Loss was higher in WY 2022 year than the previous year. The total number was approximately 28.78% higher than which was observed in the WY 2021 water year. Unlike the previous few years salvage of fry/smolt Chinook Salmon occurred a little later in the season (early February rather than December) but most of the unclipped Winter Chinook are salvaged later in the season based on the historical trend of salvage timing (Figure 5). Similar to the WY 2020 and WY 2021, salvage of the fry/smolt Chinook Salmon loss was observed during April and May (Figure 6).

The combined expanded loss of fry/smolt Chinook Salmon between October 2021 and July 2022 was approximately 1,145 fish, higher than the previous years' loss of 889.12 fish (Figure 6 and Figure 7). Using the Delta Model LAD criteria, DWR and Reclamation defined fry/smolts as all non-clipped Chinook Salmon smaller than the minimum Winter-run LAD criteria. The Delta Model LAD criteria categorizes two different brood years of Winter-run Chinook Salmon in July. For this month, DWR and Reclamation used the minimum Winter-run LAD criteria for the older brood year.

Chinook Salmon Monitoring in the Sacramento River and the Delta

The Delta Juvenile Fish Monitoring Program (DJFMP) is conducted by the USFWS. The DJFMP has been conducting juvenile Salmon monitoring in the Delta since the early 1970s, with the goals of gaining information on potential management actions that could improve the survival of juvenile salmon rearing and migrating through the Delta, and to document non-salmonid temporal and spatial distributions. For the USFWS Sacramento River and Delta surveys, DWR and Reclamation separated non-clipped older juvenile Chinook Salmon from fry/smolts using the Frank-Fisher Model (Fisher, F.W, CDFW), which categorizes two different brood years of Winter-run Chinook Salmon in July and August. DWR and Reclamation used the minimum length of the dominant brood year of a reporting period for categorizing older juveniles and fry/smolts.

Spring-Run Chinook Salmon Surrogate Monitoring

The USFWS conducted a midwater and Kodiak trawl survey on the Sacramento River at Sherwood Harbor to gauge the relative abundance and timing of juvenile Chinook

Salmon entering the Delta. Based on the preliminary data summary received in late September 2022, USFWS recovered no surrogate Spring-run Chinook Salmon from the first surrogate group, one from second surrogate group and none from the third surrogate release group in Sacramento trawls.

In addition, a midwater trawl survey was conducted at Chipps Island, the most downstream trawl survey location in the legal Delta. USFWS recovered 14 Spring-run Chinook Salmon surrogate from the first surrogate release, 11 fish from the second Spring-run Chinook Salmon surrogate release, and 5 Spring-run Chinook Salmon were observed from the third surrogate release ((Figure 8 (a,b,c)). Overall, the total of 30 recovered surrogates was significantly higher than the total of 3 Spring-run Chinook salmon surrogates recovered in WY 2021 and nearly three times higher than the catch of 11 Spring-run Chinook salmon surrogates reported in the WY 2020 year. This is somewhat similar to the total number of 35 observed in WY 2019 year. All salvage at Chipps Island occurred between late December 2021 and early March 2022. For all 3 surrogate groups salvaged, January 2022 was the highest peak of salvage. The timing of recoveries at Chipps Island for all three surrogate releases was consistent with the timing of salvage at Delta Fish Facilities.

DJFMP sampling was sometimes disrupted due to hazardous smoke and various other adverse environmental conditions as it was in the previous year. Therefore, it is difficult to compare the trend of recovered Chinook salmon for this year with the previous years. More details on the related topic can be obtained from the USFWS Delta Juvenile Fish Monitoring Program.

Hatchery Winter-Run Chinook Salmon Monitoring

Recoveries of hatchery Winter-run Chinook Salmon from LSNFH in the Delta monitoring trawls were significantly higher in WY 2022 than in WY 2021. Between late February and late March of 2022, the USFWS recovered a total of 25 hatchery Winter-run Chinook Salmon from LSNFH. A total of 4 fish were recovered in Sacramento using Kodiak Trawl a total of 18 fish were recovered at Chipps Island (Figure 9) using Midwater trawl. Three of the total 25 fish were recovered in Lower Sacramento River using the Enhanced Delta Smelt Monitoring Program (EDSM).

Central Valley Steelhead

Steelhead Incidental Take

Reclamation's 2019 Proposed Action does not include daily loss thresholds for unclipped Steelhead. Natural California Central Valley (CCV) Steelhead loss in the Proposed Action loss is divided into two time periods to protect San Joaquin origin fish that historically appear in the Mossdale trawls later than the Sacramento origin fish: Period 1 (December 1 through March 31) and Period 2 (April 1 through June 15). For

the year WY 2022, the single-year loss threshold for natural steelhead was set at 1,414 fish for period 1 and 1,552 fish for period 2. The cumulative loss threshold for period 1 is 6,038 fish and 5,826 fish for period 2.

The SWP and CVP expanded salvage of non-clipped steelhead was approximately 38 fish and 109 fish respectively, for a total of 147 fish for the WY 2022 year (Figure 10, Figure 11). The annual expanded salvage of non-clipped steelhead for WY 2022 increased from WY 2021, when it was 48. It was unlike the comparison trend observed in previous years when it was 143 in WY 2020 and decreased by nearly 50% from the total expanded salvage of 446 in the year WY 2019 (Figure 12). The total number of salvage in the year WY 2022 was much lower than the average for WY 2008 - WY2021 (Figure 12).

Loss of natural CCV steelhead for Period 1 (Dec 1 – Mar 31) was 8.8% of the cumulative loss threshold set for that period and was 8.1% loss for Period 2 (Apr 1 – June 15), the cumulative loss threshold set for that period in the 2019 PA. Loss of natural CCV steelhead for Period 1 (Dec 1 – Mar 31) was 84.28 fish, or 11.9% of the single-year loss threshold set for that period in the 2019 PA. Loss of natural CCV steelhead for Period 2 (Apr 1– June 15) was 154.38 fish, or 19.8% of the single-year loss threshold set for that period in the 2019 PA. There were steelhead observed in October and November of 2021. Per the agreement of representatives of different regulatory agencies, they were included in the Dec 1- March 31 period regardless of their salvage timing outside the effective period for steelhead take limit.

During WY 2022 neither of the single-year loss thresholds for period 1 or period 2 were exceeded. Additionally, the cumulative loss thresholds (6,038 for period 1 and 5,826 for period 2) were not exceeded for either period 1 or period 2 for the WY 2022 year.

The SWP and CVP expanded salvage of hatchery (adipose fin clipped) steelhead increased in WY 2022 compared to the previous year (Figures 11 and 13). From October 2021 to July 2022, the CVP salvaged a total of 285 hatchery fish and the SWP salvaged a total of 103 hatchery fish for a combined total annual salvage of 388 hatchery steelhead (Figures 11 and 13), which is higher than the total expanded salvage of 188 in WY 2021 but lower than a total of 428 salvaged in WY 2020 (Figures 11 and 13).

Green Sturgeon Incidental Take

The incidental take level for Green Sturgeon remained at 74 fish for Water Year 2021 based on historical salvage per 2019 BiOps. Similar to the previous year, there was no salvage of Green Sturgeon at either fish facility for the year WY 2022. In the WY 2020 water year, an expanded salvage of eight Green Sturgeon was observed at the CVP Facility. An expanded salvage of four was observed in the year of WY 2019. Before that, the last Green Sturgeon was observed at the Federal Facility in the Water Year

2011/2012. The last Green Sturgeon was observed at SWP in Water Year WY 2016 (Figure 15).

Delta Hydrology

The WY 2022 water year ended being the fourth year of drought with much higher-than-average temperatures and a lack of rain. Water year WY 2022 ended with an average statewide precipitation of 17.9 inches, which is 76% of what was observed historically. Extreme dry condition during this year lowered the reservoir storage level to 60 percent of the average. The Snowpack condition overall was also under average during WY 2022. According to the California Cooperative Snow Survey Program, in April 2022 the snowpack was measured to be only 38 percent of the average for that time of year. More Delta-specific information on current hydrology of California for the year WY 2021 can be found at https://cdec.water.ca.gov.

Overall, average exports for Sacramento River were higher and for San Joaquin River were lower during WY 2022 WY than they were in the year of WY 2021. Table 4 shows a monthly average summary of SWP and CVP exports, Sacramento and San Joaquin River flows, and Delta outflow. Figure 16 (a, b, c, d) shows the monthly averages of Delta hydrologic conditions (Delta outflow, SWP and CVP exports, Sacramento River flow at Freeport, and San Joaquin River flow at Vernalis) for the Water Years 2017 through 2022.

Modeled volumetric water fingerprints derived from the Delta Simulation Model 2 (DSM2) at Clifton Court Forebay (SWP) and at the Jones Pumping Plant (CVP) are presented in Figures 17 and Figure 18. In the WY 2022 water year, the majority of SWP water came from the Sacramento River (Figure 17) which is similar to the previous year of WY 2021 but different than the year WY 2020 and the year WY 2019 when most of the SWP water came from San Joaquin River. In WY 2022, the majority of CVP water came from the Sacramento River, which was different than the trend observed in the year of WY 2020 and the year WY 2019 when majority of CVP water came from San Joaquin River (Figure 18).

References

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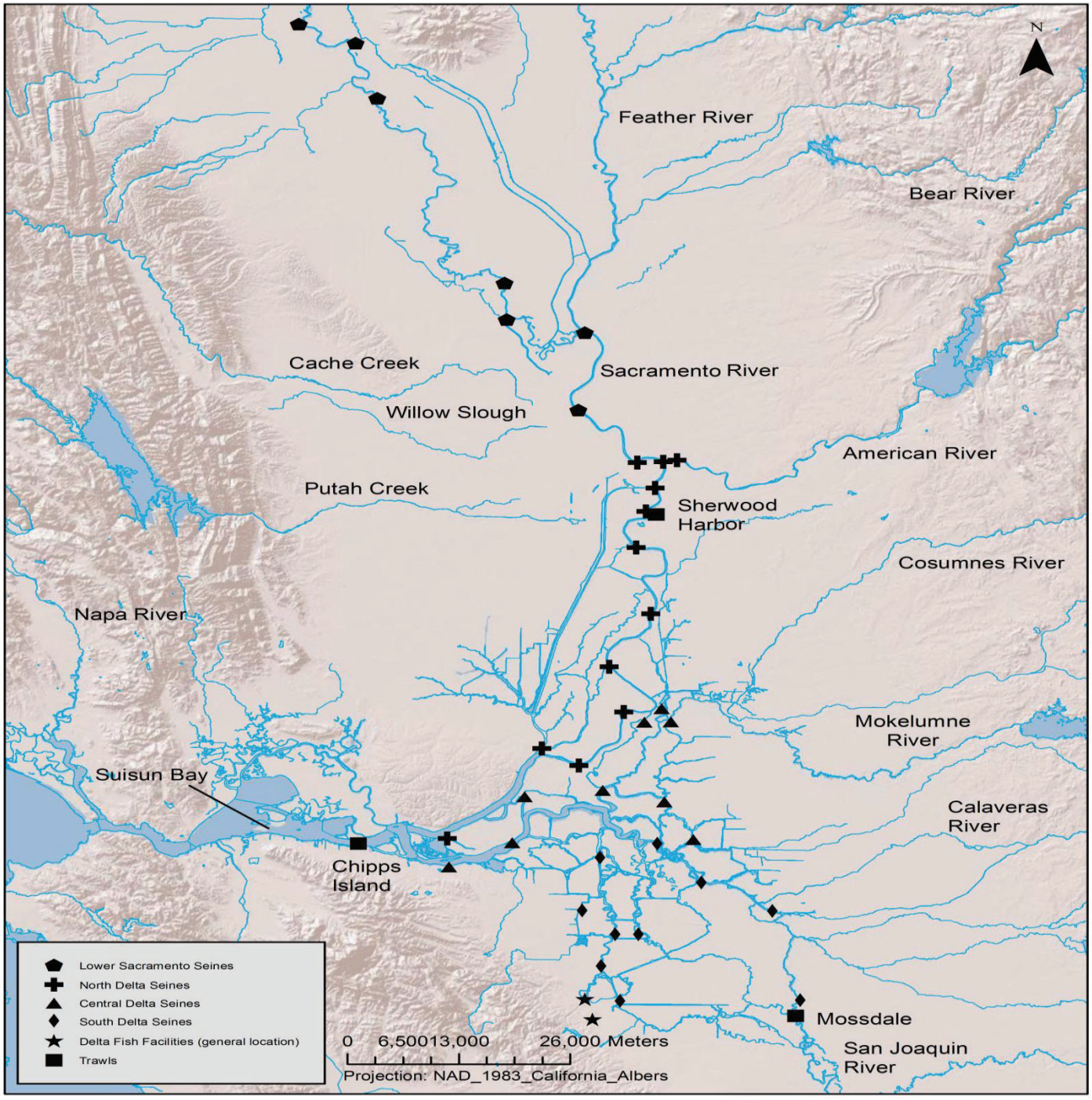
Figure 1. Map of monitoring sites used in this report.



Base map from ESRI and GPS coordinates provided by USFWS. Only seine sites that have been active since August 2004 are presented.

Figure 2. Observed Chinook Salmon salvage at the Delta fish facilities, with Delta hydrology, October 1, 2021, through September 30, 2022. Chinook Salmon race/run designation is based on Delta model length-at-date criteria and Coded Wire Tag recoveries.

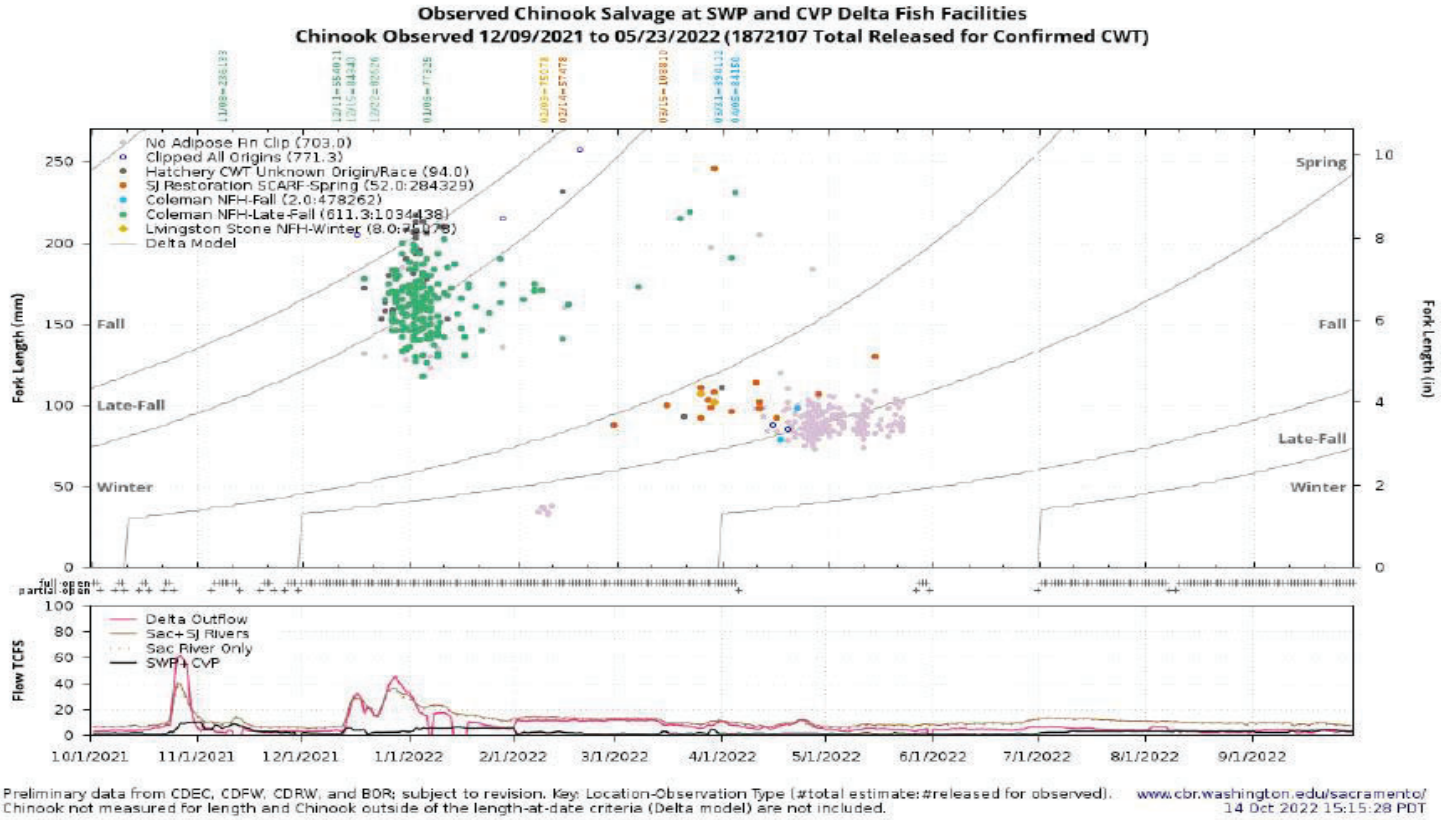


Figure 3. Daily loss and loss density of non-clipped Winter-run length and older juvenile Chinook Salmon at the Delta fish facilities using the current loss equation (DFW 2013), October 1, 2021, through Sept. 30, 2022.

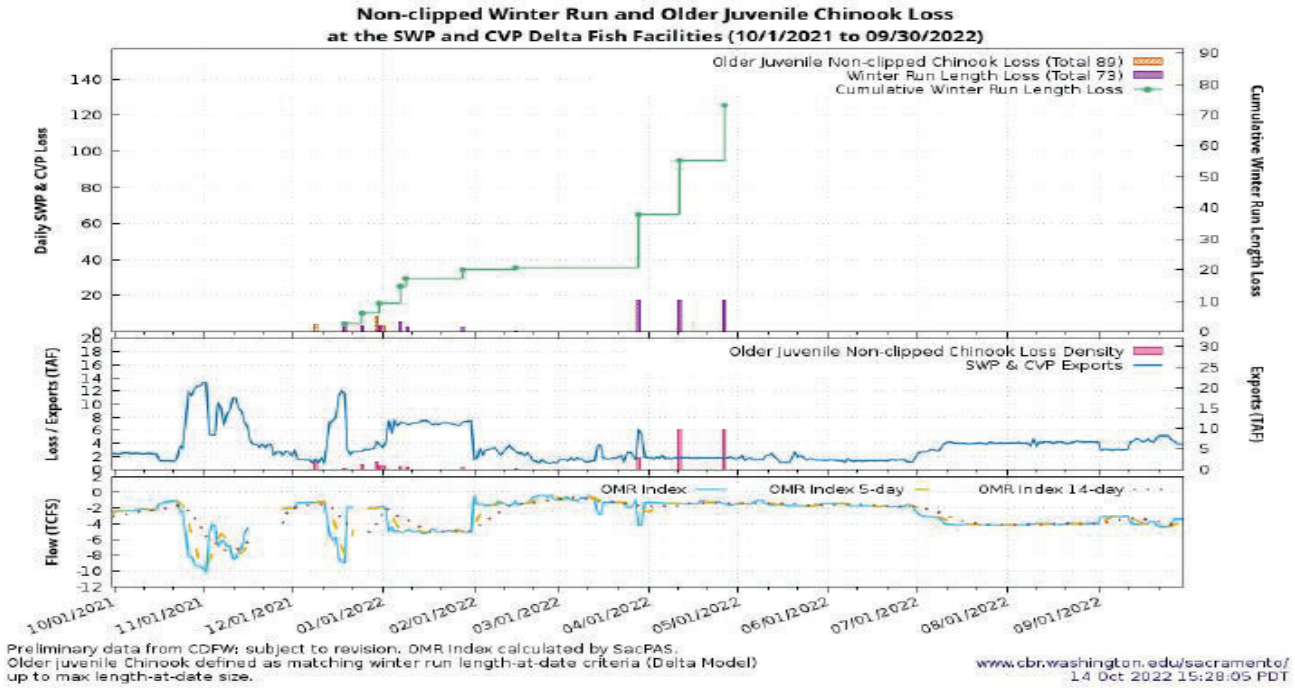


Figure 4. Non-clipped Winter-run length Chinook Salmon percent loss at the Delta fish facilities from October to June using the current loss equation (DFW 2013), Water Years 2011 through 2022. Percent noted above each bar is percent loss based on the annual incidental take permitted for that water year.

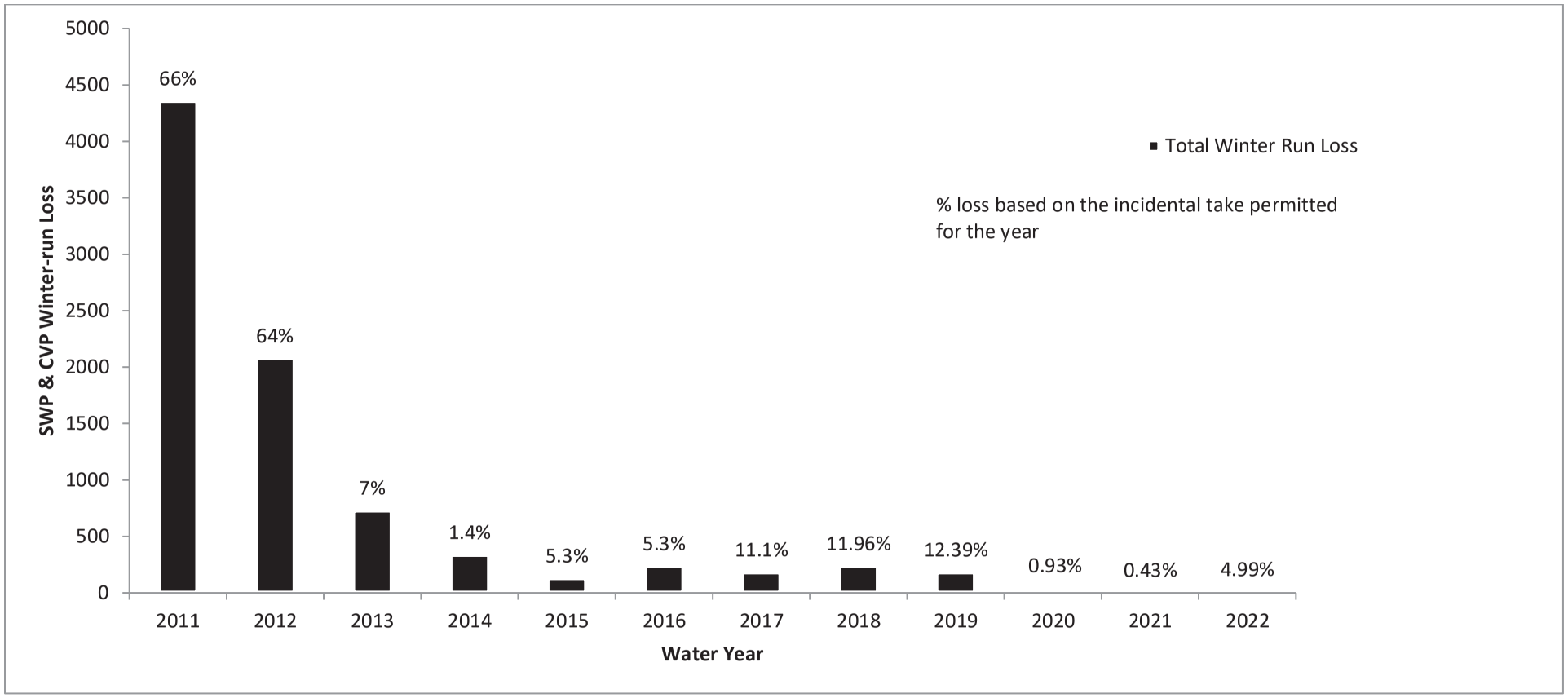


Figure 5. Unclipped Winter Chinook Expanded salvage number and timing at SWP and CVP, water years 2008-2022.

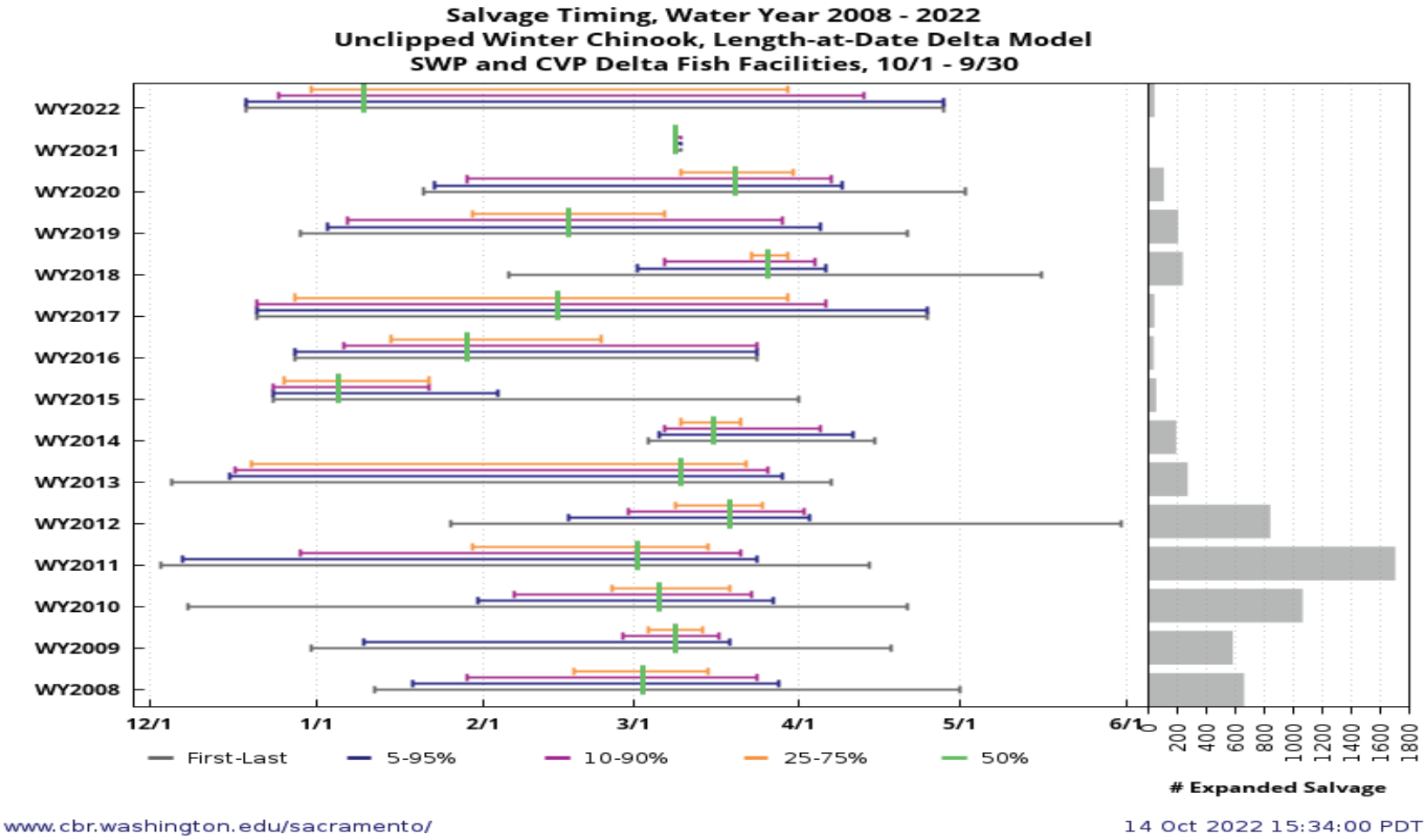


Figure 6. Daily loss and loss density of non-clipped fry/smolt Chinook Salmon at the Delta fish facilities using the current loss equation (DFW 2013), October 1, 2021, through September 30, 2022.

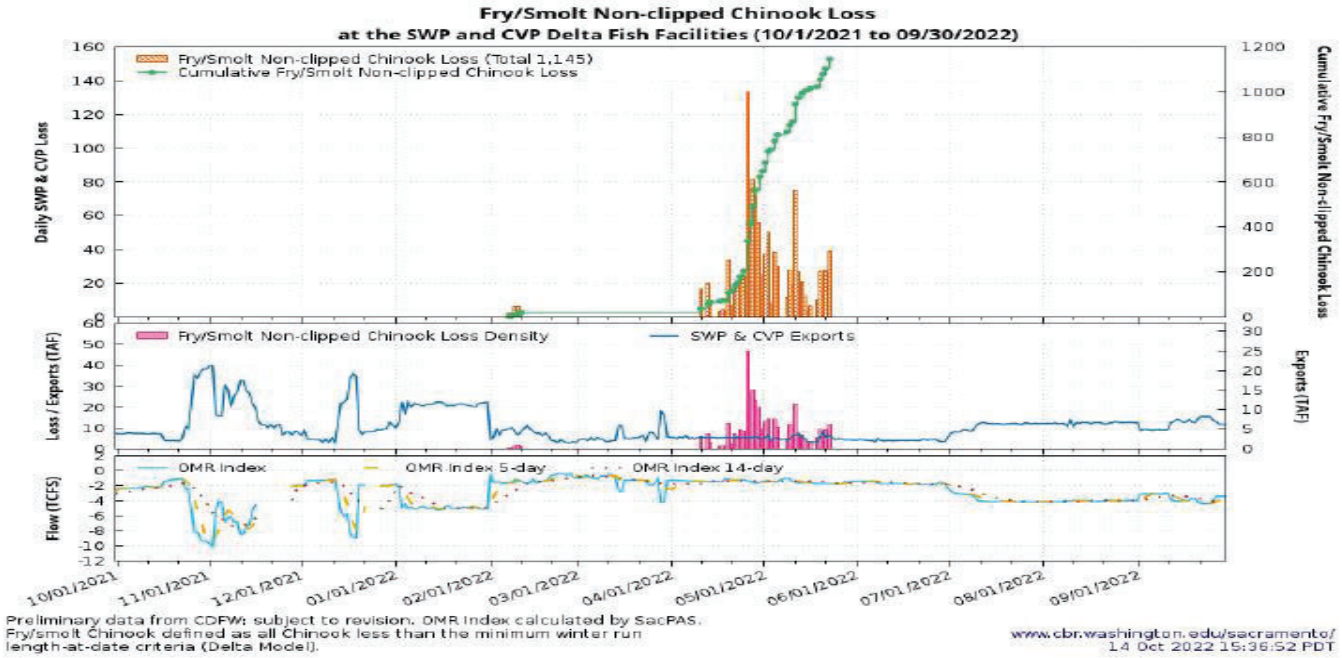
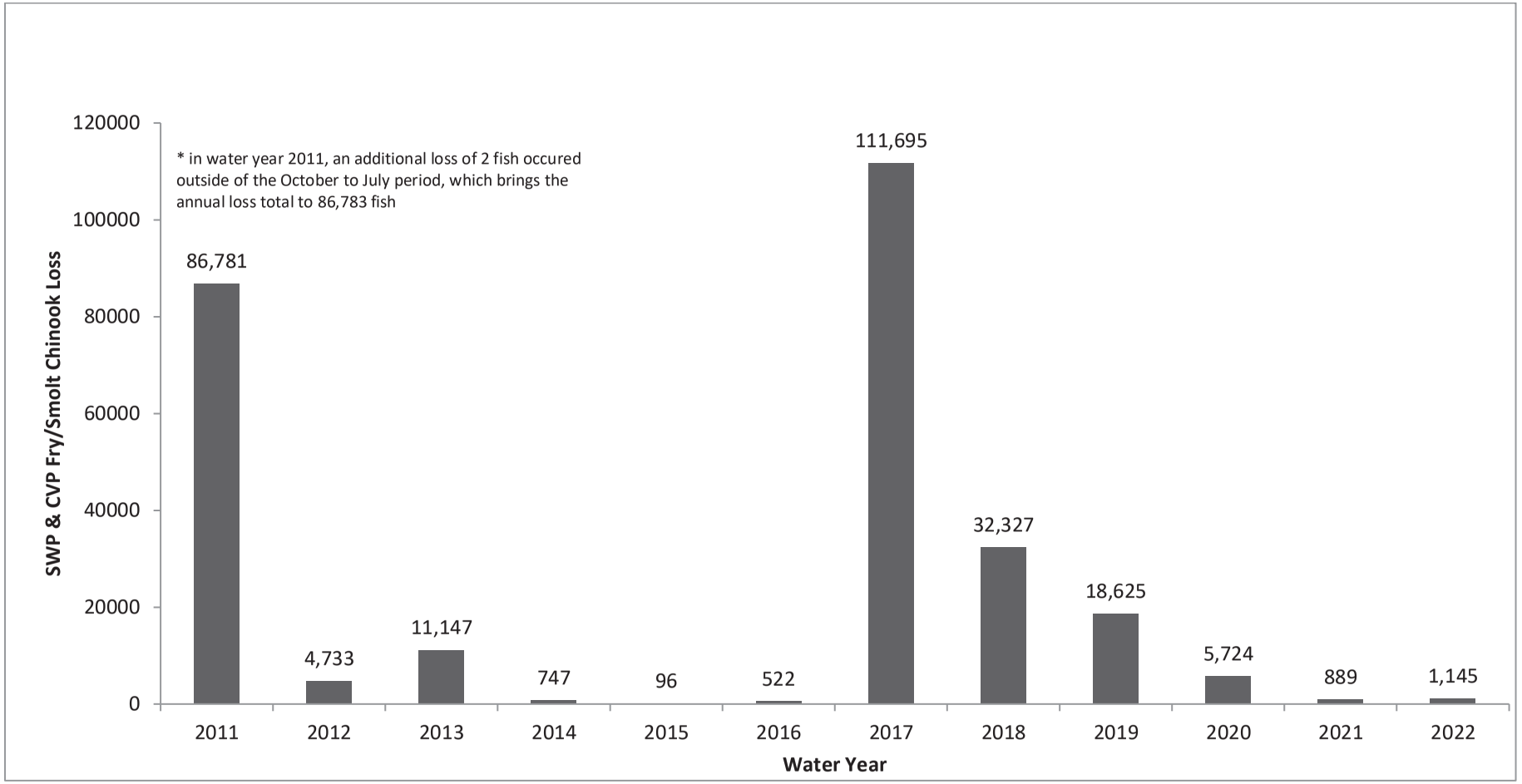


Figure 7. Non-clipped fry/smolt Chinook Salmon loss at the Delta fish facilities from October to July using the current loss equation (DFW 2013), Water Years 2011 through 2022.



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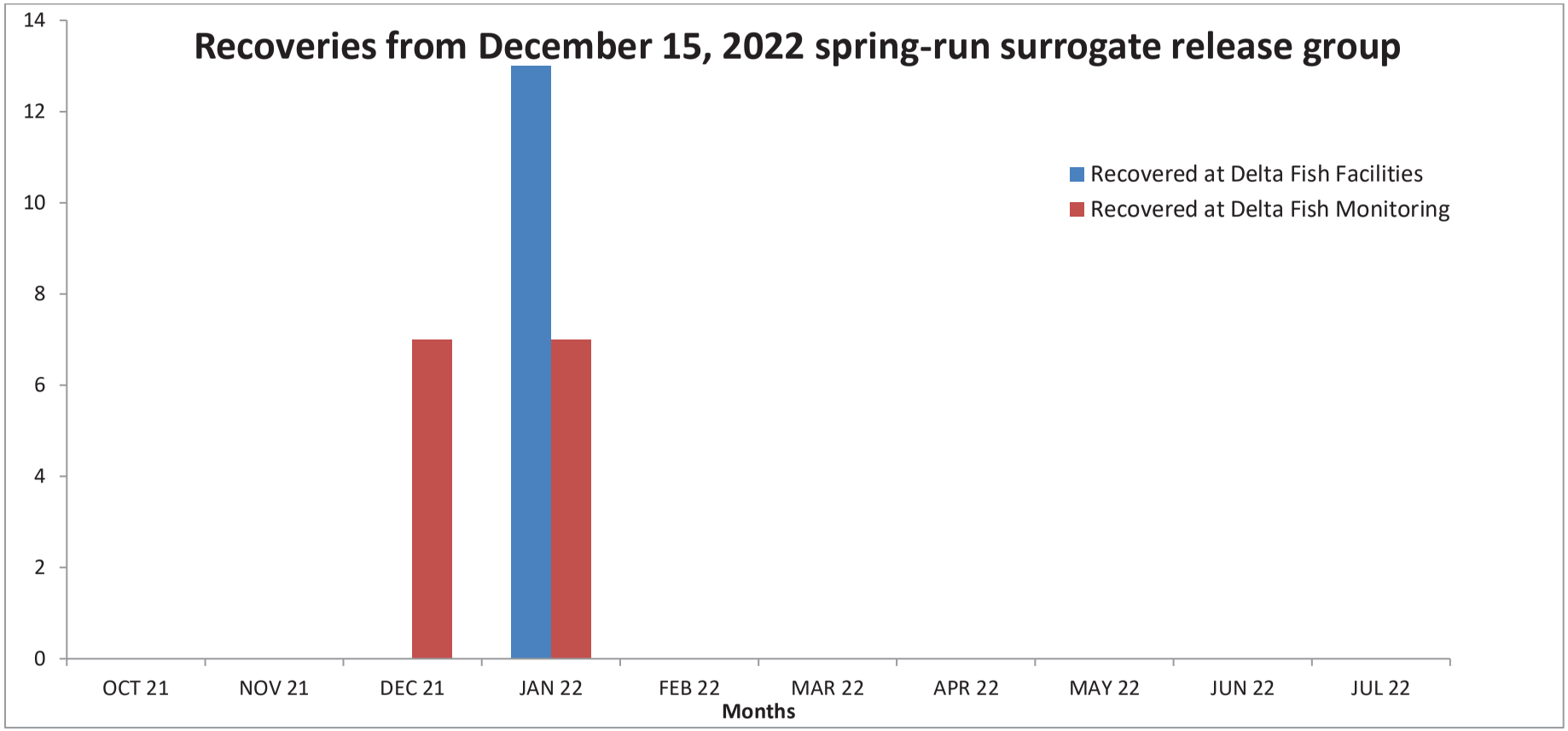

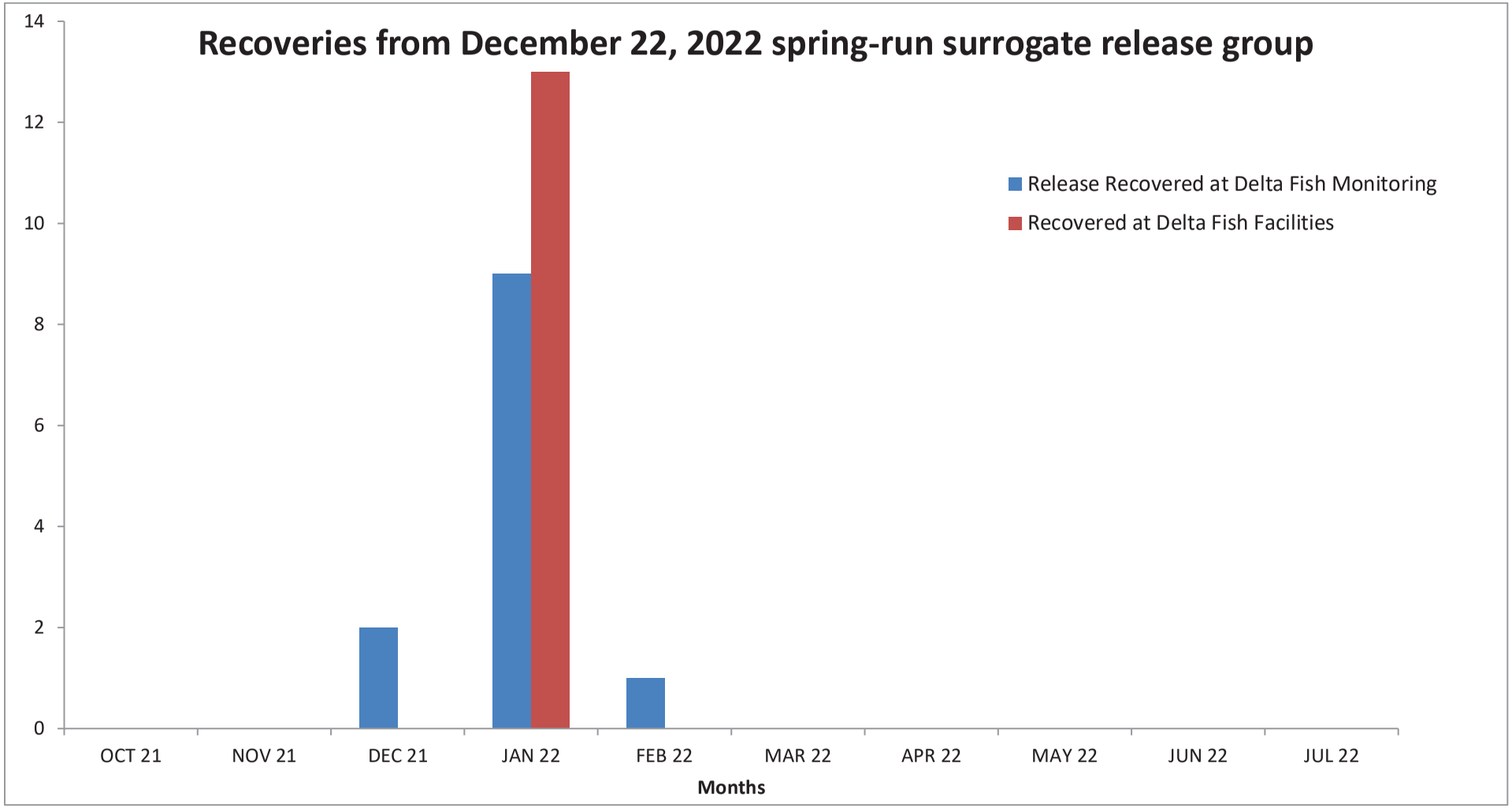

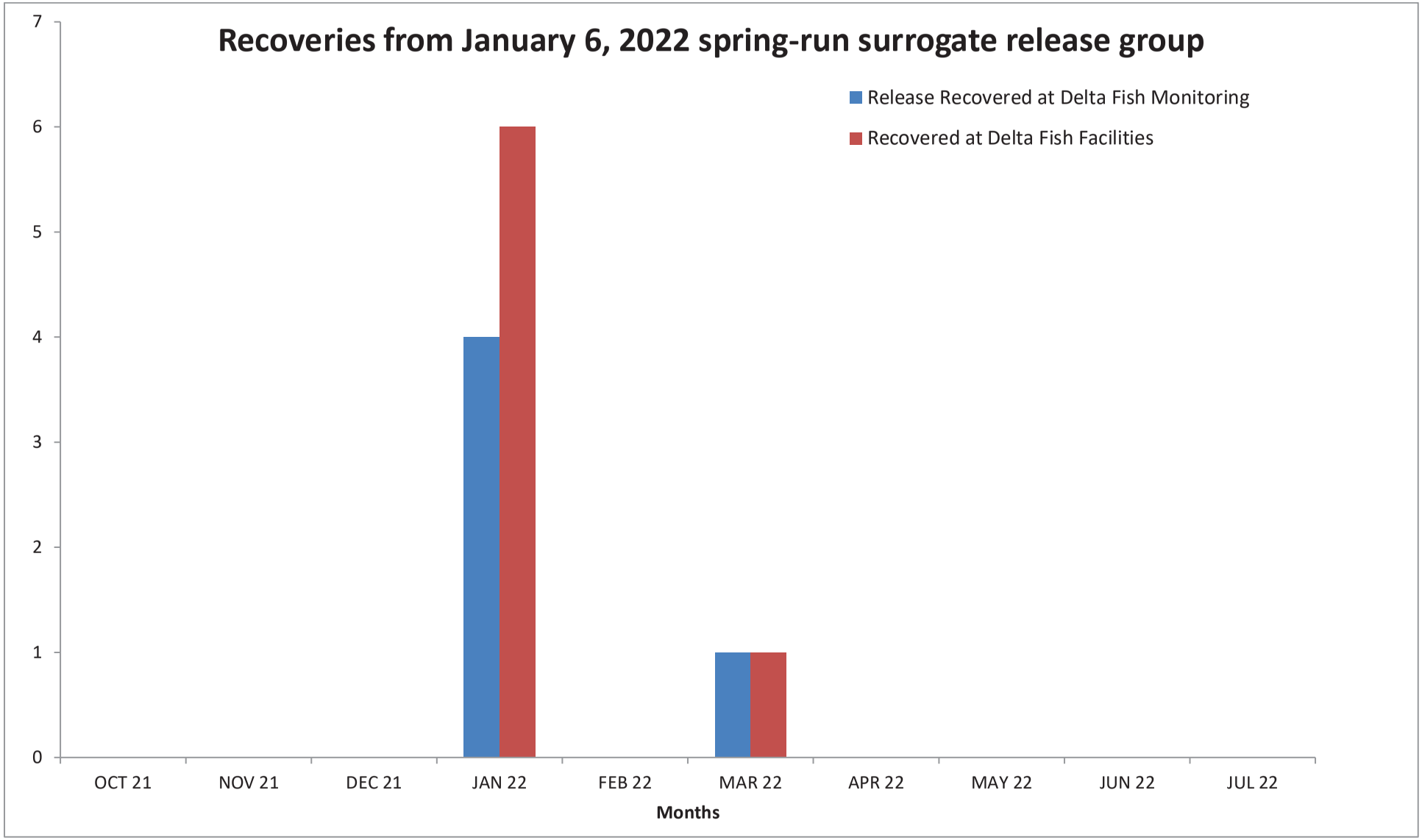

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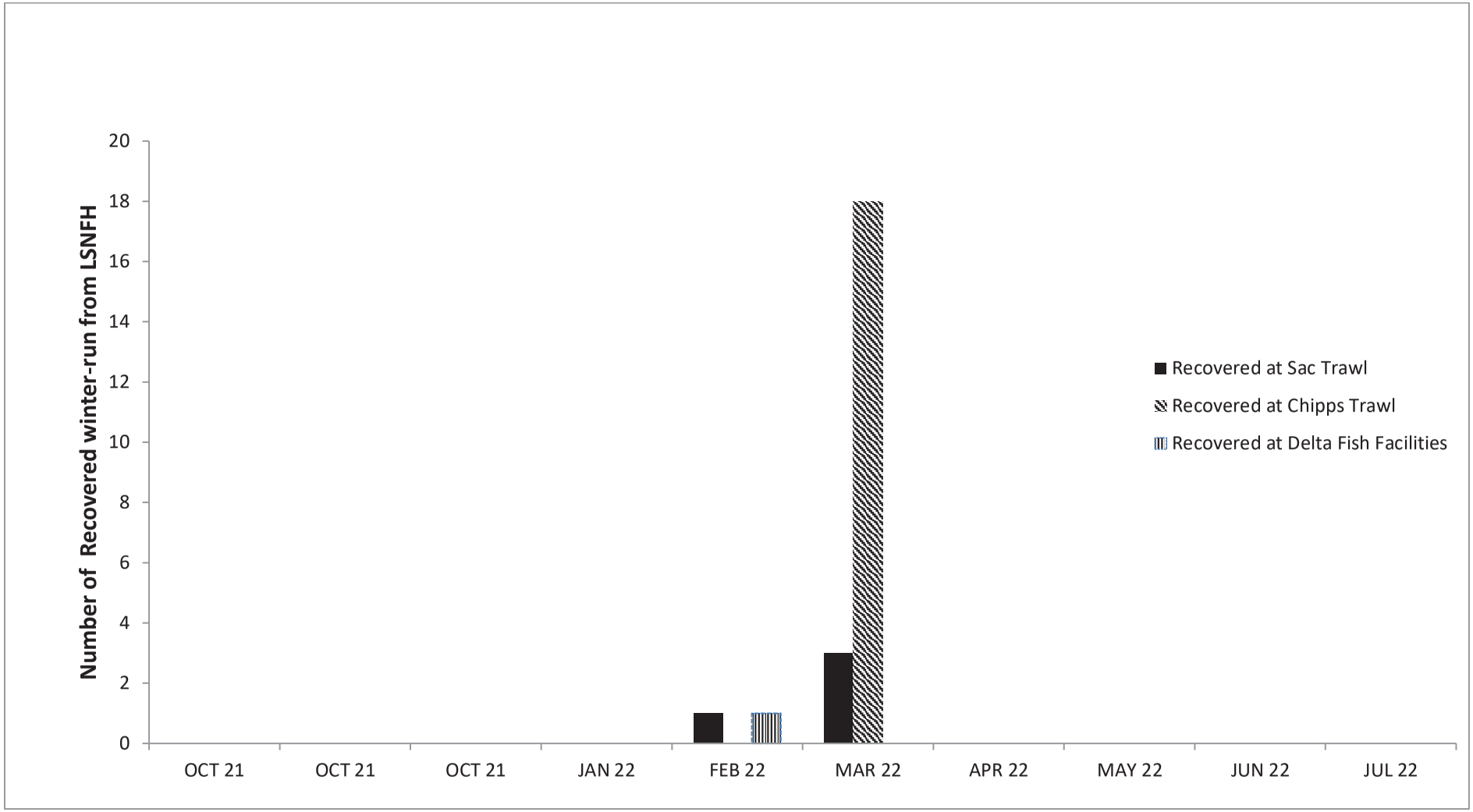

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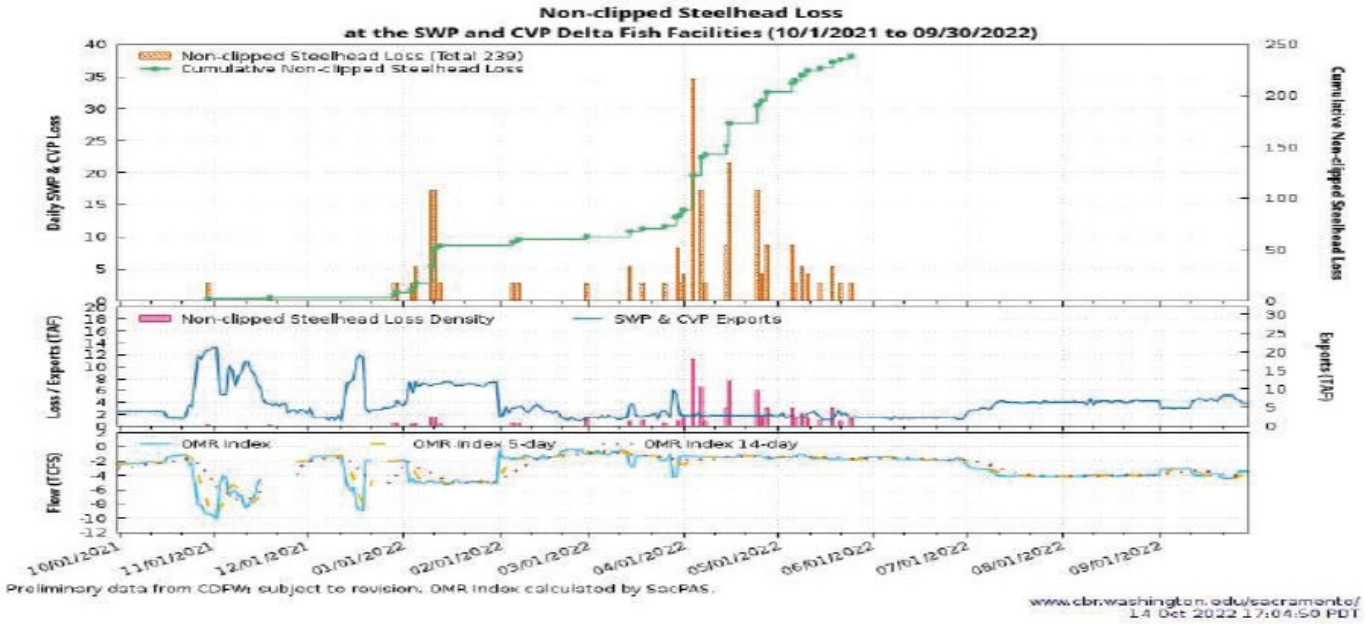

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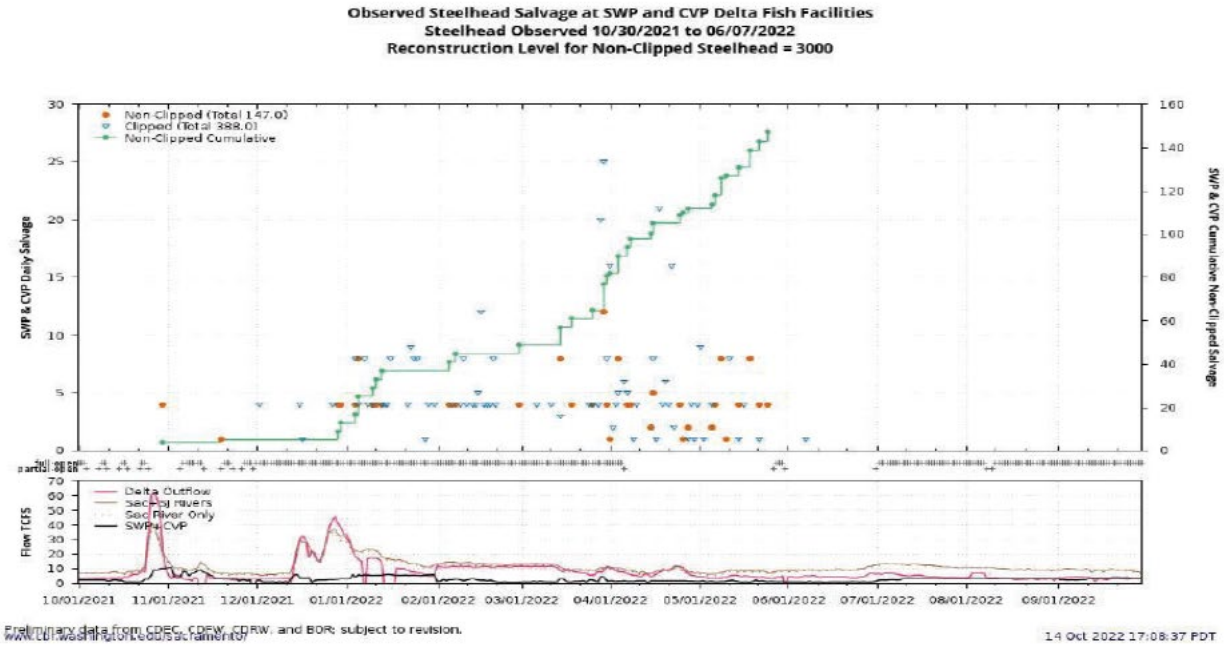


Figure 12. Natural (non-clipped) steelhead salvage at the Delta fish facilities from October to July, Water Years 2008 through 2022.

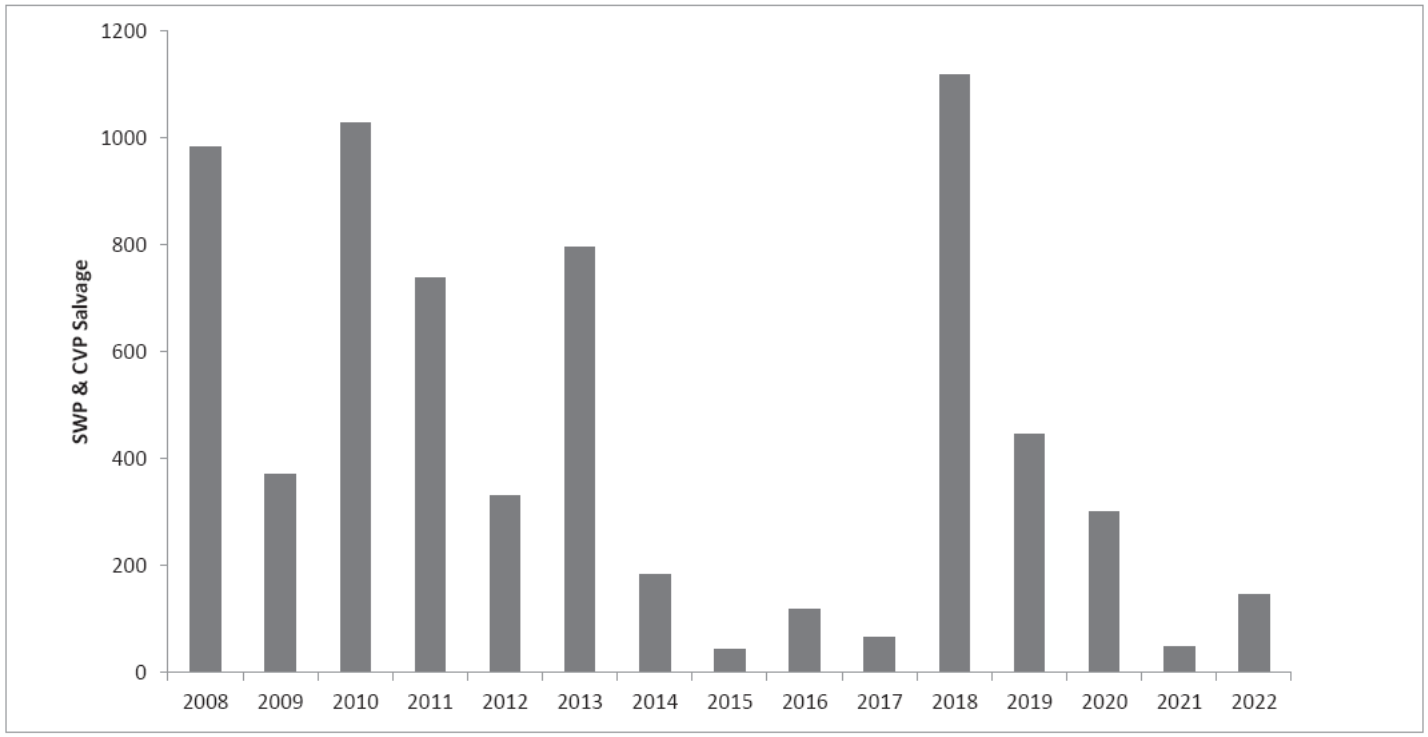


Figure 13. Hatchery (adipose fin clipped) steelhead salvage at the Delta fish facilities from October to July, Water Years 2008 through 2022.

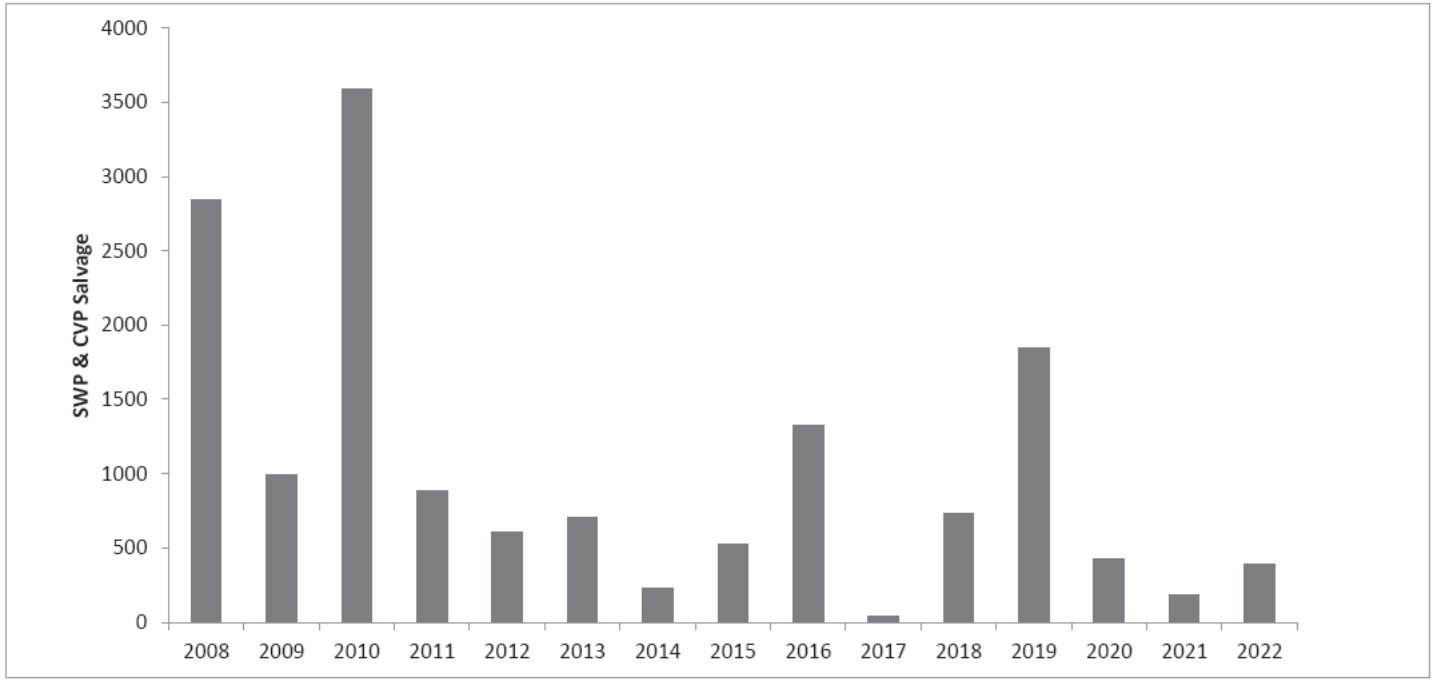
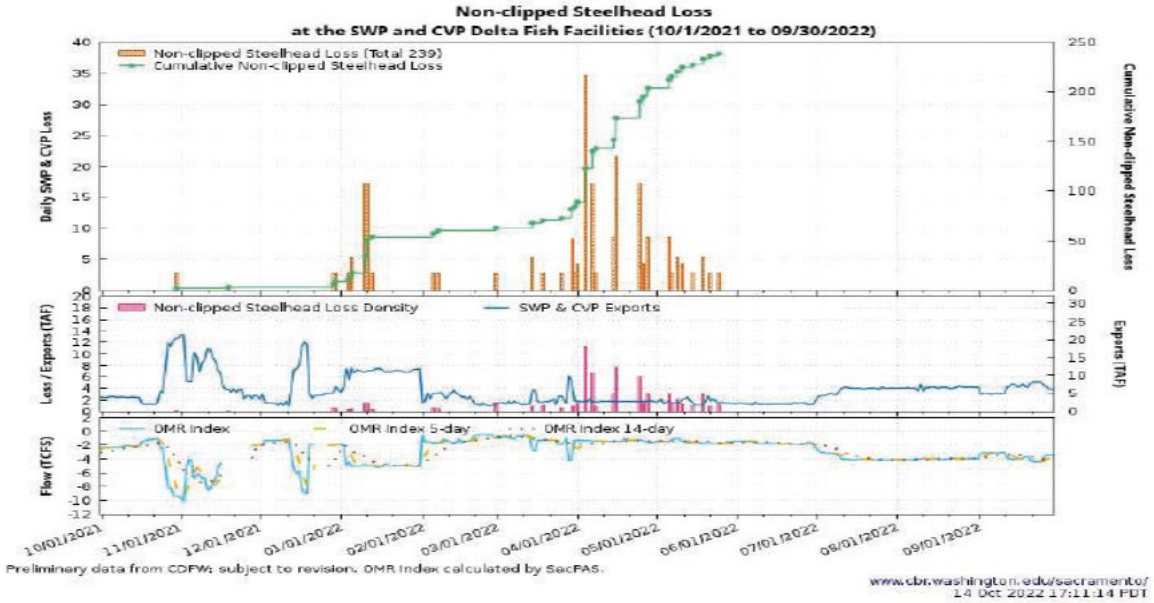


Figure 14. Daily loss and loss density of non-clipped steelhead at the Delta fish facilities using the current loss equation (DFW 2013), October 1, 2021, through September 30, 2022.



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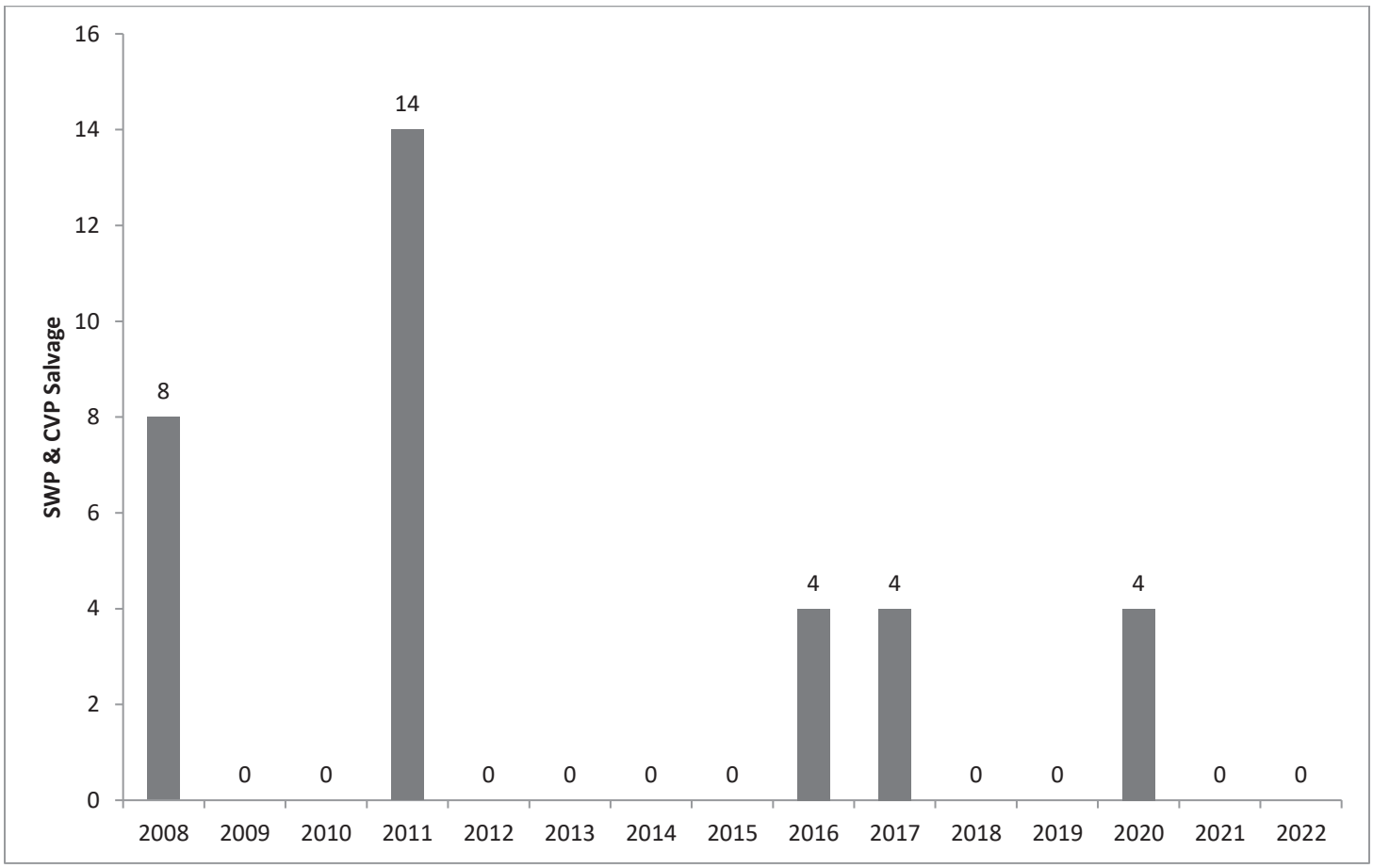

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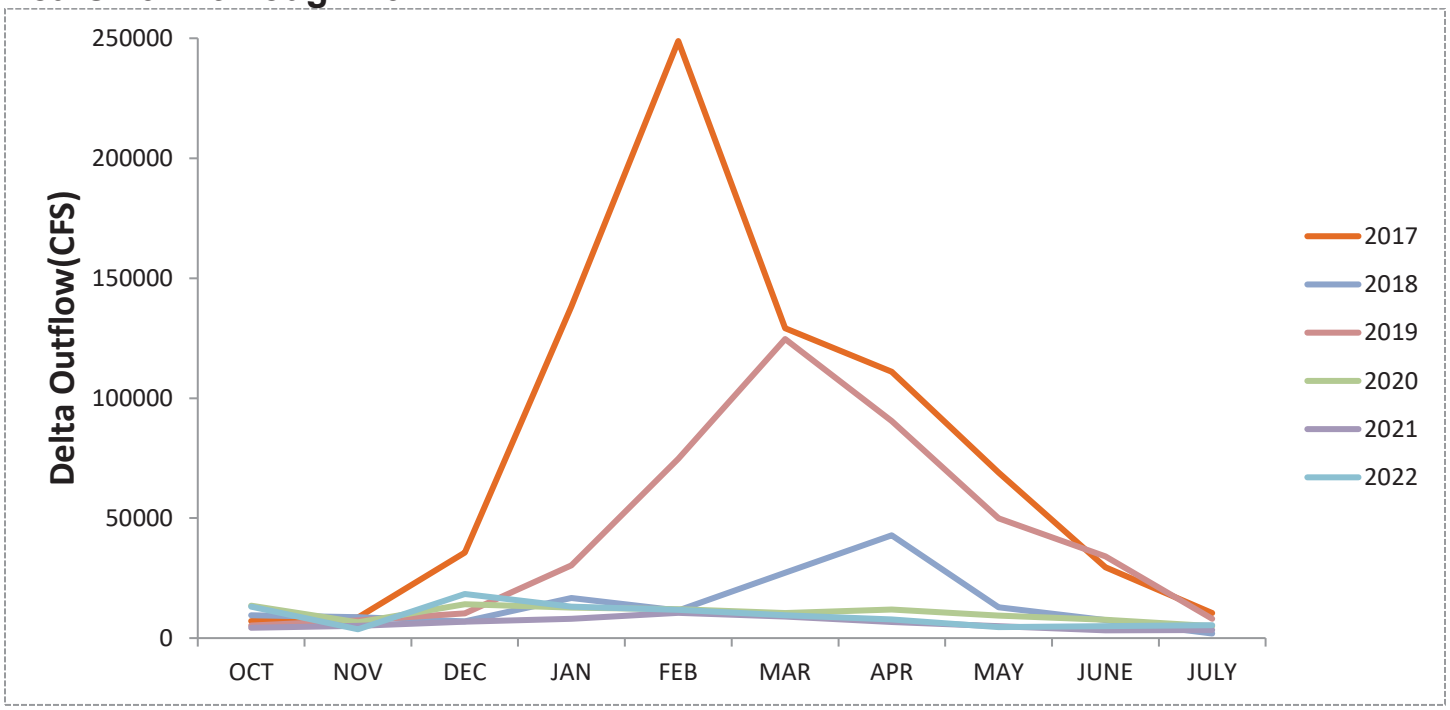

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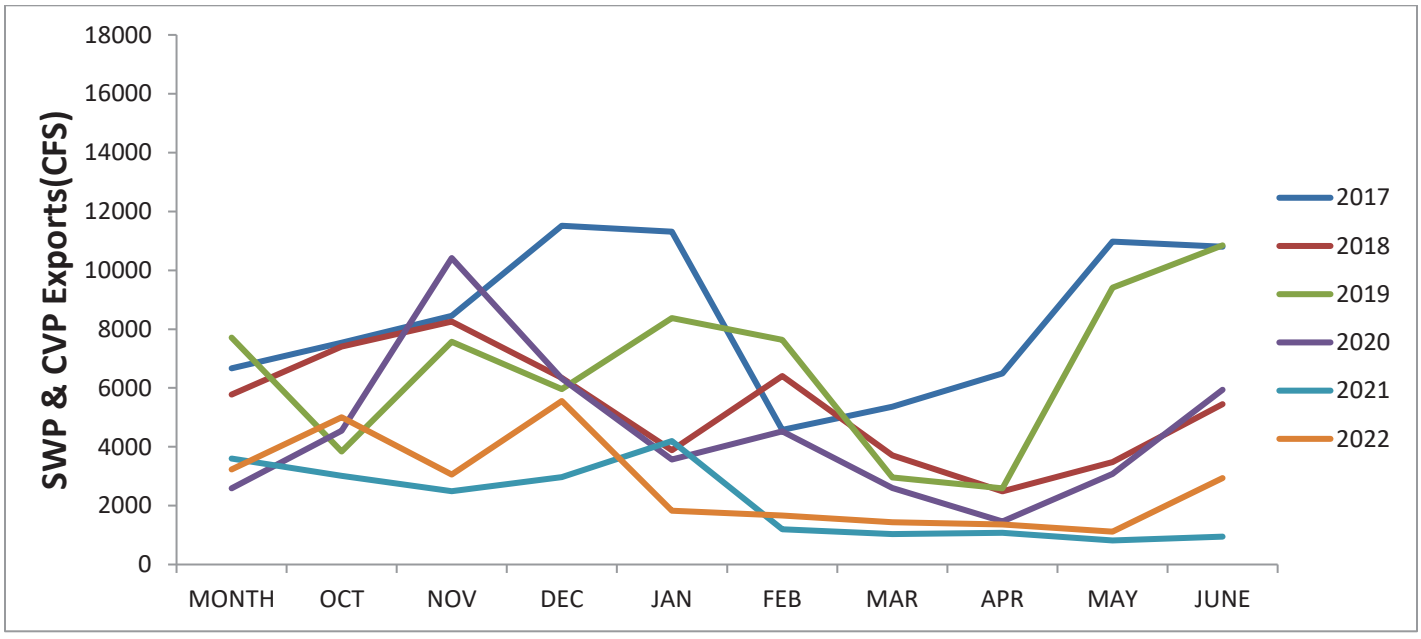
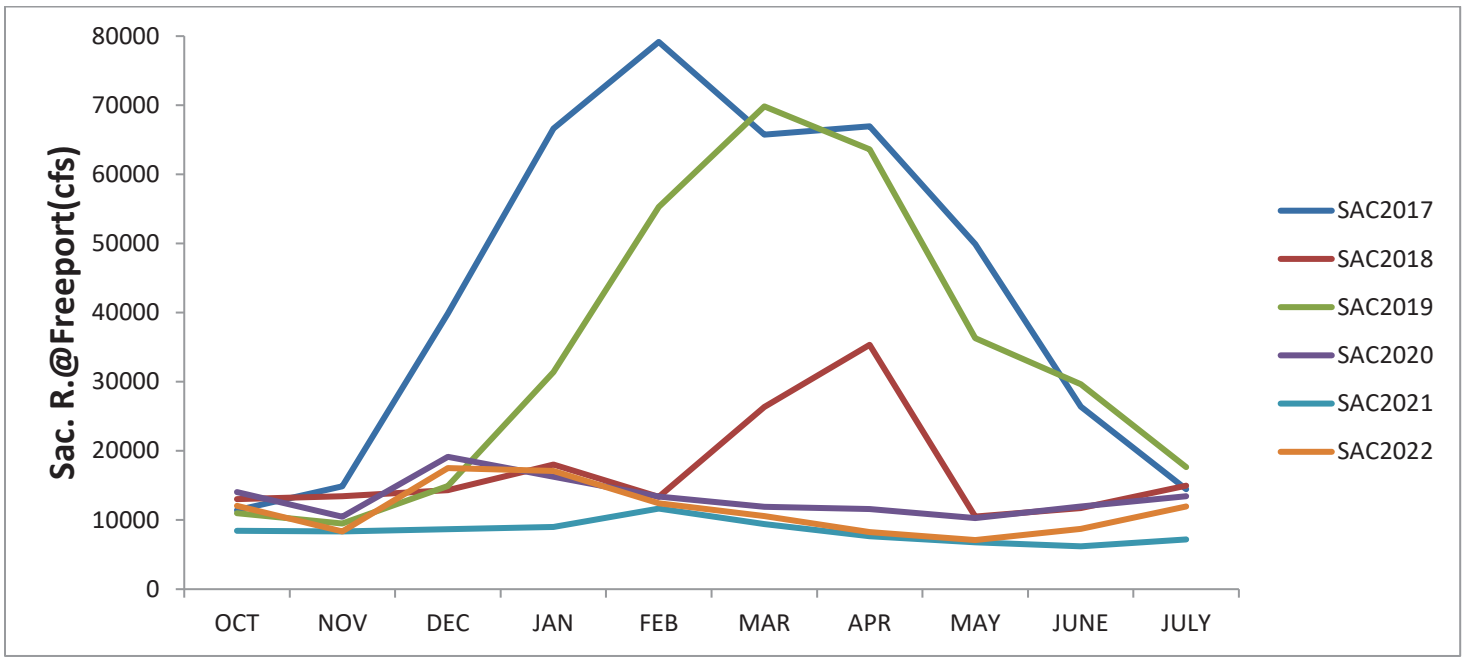


Figure 16c. Monthly averages of Sacramento River flow at Freeport from October to July, Water Years 2017 through 2022.



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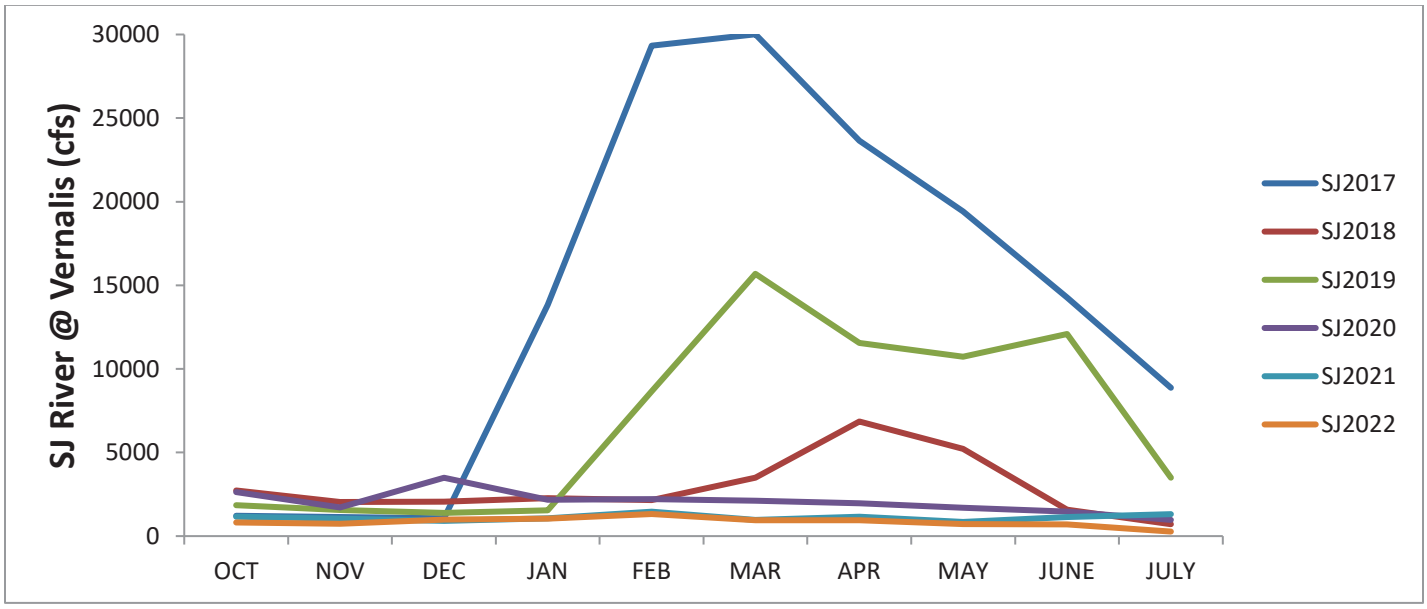
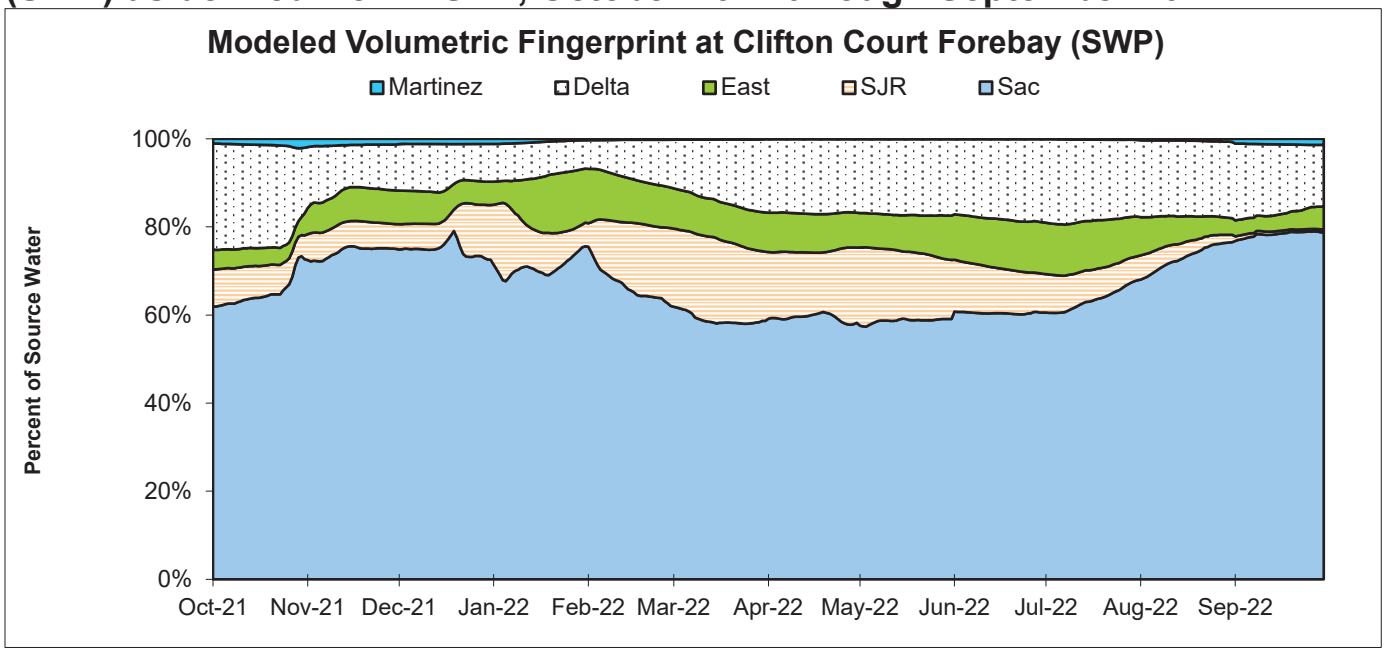
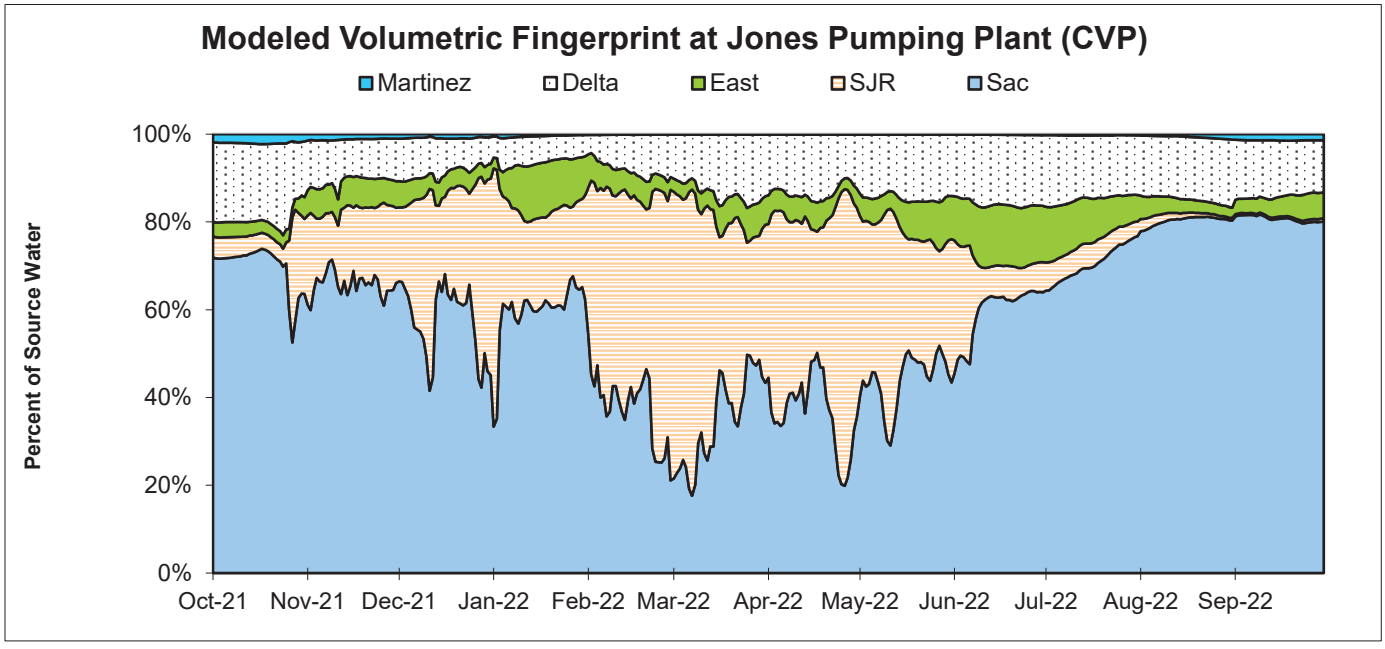


Figure 17. Modeled volumetric water fingerprint for the Clifton Court Forebay (SWP) as derived from DSM2, October 2021 through September 2022.



Sacramento-San Joaquin WY 2021 Delta fingerprint figure from DWR-Operations Control Office

Figure 18. Modeled volumetric water fingerprint for the Jones Pumping Plant (CVP) as derived from DSM2, October 2021 through September 2022.



Sacramento-San Joaquin WY 2021 Delta fingerprint figure from DWR-Operations Control Office

Table 1. Genetic run identification for juvenile Chinook Salmon salvaged at the Delta fish facilities, October 2021 through June 2022.

CVP	LOD	Genetics[1]	SWP	LOD	Genetics[1]
FR	83	96	FR	51	101
SR	37	5	SR	59	3
WR	9	0	WR	3	0
LF	5	0	LF	1	0
Failed / No Results		33	Failed / No Results		10

Table 2. Unknown hatchery (adipose fin clipped) Chinook Salmon loss at the Delta fish facilities using the current loss equation (DFW 2014), October 2021 through June 2022.

Facility	Unknown CWT Loss[5]	Unread CWT Loss[6]	Unknown Hatchery Loss[7]	Acoustic Tag Loss[8]	Number of Unassigned CWTs[9]
SWP	25.980				
CVP	66.181				
TOTAL	**92.161**				

[5]Adipose-fin clipped Chinook was observed during fish count, but tag code could not be determined (e.g., damaged tag, lost tag, no tag, or Chinook released).

[6]Adipose-fin clipped Chinook was collected during fish count and has not been processed yet.

[7]CWT has been read, but hatchery release information not yet available.

[8]Adipose-fin clipped Chinook released due to presence of sutures.

[9]CWT cannot currently be assigned to a salvage record with certainty since the CWT was lost and then found. CWT may be assigned to a salvage record if new information is available.

Table 3. Hatchery (adipose fin clipped) Chinook Salmon loss at the Delta fish facilities using the current loss equation (DFW 2014), October 2021 through June 2022.

Release Date	CWT Race	Hatchery	Release Site	Release Type	Confirmed Loss	Number Released [1]	Total Entering Delta	% Loss of Number Released[2]	% Loss of Total Entering Delta[3]	First Stage Trigger	Date of First Loss[4]	Date of Last Loss[4]
12/15/21	LF	Coleman NFH	Battle Creek	Spring Surrogate	48.611	84, 343	n/a	0.058	n/a	0.5%	1/01/22	1/11/22
12/22/22	LF	Coleman NFH	Battle Creek	Spring Surrogate	17.620	82,626	n/a	0.021	n/a	0.5%	1/03/2022	1/18/22
1/06/22	LF	Coleman NFH	Battle Creek	Spring Surrogate	20.054	77,325	n/a	0.026	n/a	0.5%	1/16/22	3/20/22

[1]Number released with the adipose-fin clipped and a coded-wire tag (CWT).

[2]% Loss of Number Released = (Confirmed Loss/Number Released) *100.

[3]% Loss of Total Entering Delta= (Confirmed Loss/Total Entering Delta) *100.

[4]Date of first and last loss accounts for all CWT loss even those from special studies where salvage and loss=0.

Table 4. Monthly averages of hydrologic parameters in the Sacramento-San Joaquin River Delta, October 2021 through July 2022.

Month	SWP (Banks) Average Pumping taf	SWP (Banks) Average Pumping cfs	CVP (Jones) Average Exports taf	CVP (Jones) Average Exports cfs	Sacramento River Average Flow cfs	San Joaquin River Average Flow cfs	Delta Outflow Average Flow cfs
Oct	92	1498	106	1732	12035	808	13136
Nov	114	1920	184	3084	8370	737	3682
Dec	77	1250	111	1812	17516	991	18385
Jan	107	1794	224	3763	17103	1049	13135
Feb	24	426	78	1404	12404	1320	11727
Mar	29	479	73	1183	10567	950	9559
Apr	32	533	54	901	8261	940	7719
May	28	451	56	909	7104	714	4554
Jun	12	205	54	911	8736	707	4936
Jul	31	508	149	2425	11985	270	5323

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