2022 & 2023 RED BLUFF DIVERSION DAM ROTARY TRAP JUVENILE ANADROMOUS FISH ABUNDANCE ESTIMATES

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Abstract. The Red Bluff Fish and Wildlife Office developed a new binomial generalized linear modeling (GLM) method for estimating juvenile salmonid passage using 44 mark-recapture trials conducted between 2018 and 2023 with rotary screw-traps sampling at the Red Bluff Diversion Dam (RBDD) site. This modeling method allows for the use of 5' and 8' cones in any gates sampled, enabling flexibility in sampling operations while providing more accurate trap efficiency results. The 44-trial binomial GLMs were employed to produce salmonid passage and production estimates for brood year (BY) 2022 and 2023 and to revise estimates for BY2020 and 2021 juvenile salmonids.

BY2022 and 2023 total estimated winter Chinook Salmon juvenile passage was 184,746 and 896,299, respectively. The BY2022 winter Chinook Salmon fry-equivalent juvenile production index (JPI) value of 269,901 was the lowest estimated JPI in the 27-year history of the project and 39% lower than the prior lowest value of 440,951 in 2015. The BY2023 winter Chinook Salmon fry-equivalent JPI value of 1,208,714 was the eighth lowest value and 31% below the geometric mean of the last twenty-two years of data collection on juvenile winter Chinook Salmon at RBDD.

Following genetic corrections and subtraction of unmarked hatchery smolts, BY2022 and 2023 spring Chinook Salmon total juvenile estimated passage was 66,631 and 127,165, respectively. After subtraction of *unmarked* hatchery smolts, mark-corrected BY2022 and 2023 fall Chinook Salmon juvenile estimated passage was 3,615,743 and 1,865,876, respectively. BY2022 and 2023 late-fall Chinook Salmon juvenile estimated passage was 9,292 and 41,140, respectively. BY2022 *O. mykiss* juvenile total estimated passage was 22,327. BY2023 *O. mykiss* juvenile total estimated passage was 49,542.

Annual Green Sturgeon catch per unit volume (CPUV) for 2022 was 0.02 fish/ac-ft. Annual Green Sturgeon CPUV for 2023 was 37.05 fish/ac-ft, the highest recorded CPUV estimate in 26 years of annual monitoring**.** Lamprey CPUV for WY2023 was 37.0 fish/ac-ft for unidentified lamprey ammocoetes and 37.6 fish/ac-ft for Pacific Lamprey.

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Introduction

The United States Fish and Wildlife Service (USFWS) has conducted direct monitoring of juvenile Chinook Salmon (*Oncorhynchus tshawytscha*) passage at Red Bluff Diversion Dam (RBDD) river kilometer 391 on the Sacramento River, California since 1994 (Johnson and Martin 1997). Martin et al. (2001) developed quantitative methodologies for indexing juvenile Chinook Salmon passage using rotary-screw traps (RST) to assess the impacts of the United States Bureau of Reclamation's (USBR) RBDD Research Pumping Plant. Absolute abundance (production and passage) estimates were needed to determine the level of impact from the entrainment of salmonids and other fish community populations through RBDD's experimental 'fish friendly' Archimedes and internal helical pumps (Borthwick and Corwin 2001). The original project objectives were met by the year 2000 and funding of the project was discontinued.

From 2001 to 2008, funding was secured through a CALFED Bay-Delta Program grant for annual monitoring operations to determine the effects of restoration activities in the upper Sacramento River aimed primarily at winter Chinook Salmon[1]. The USBR, the primary proponent of the Central Valley Project (CVP), has funded this project since 2010 due to regulatory requirements contained within the National Marine Fisheries Service's (NMFS) Biological Opinion for the Long-term Operations of the CVP and State Water Project (NMFS 2009 and 2019).

Protection, restoration, and enhancement of anadromous fish populations in the Sacramento River and its tributaries are important elements of the Central Valley Project Improvement Act (CVPIA), Section 3402. The CVPIA has a specific goal to double populations of anadromous fishes in the Central Valley of California. Juvenile salmonid production monitoring is an important component authorized under Section 3406 (b) (16) of CVPIA (USFWS 1997) and has funded many anadromous fish restoration actions which were outlined in the CVPIA Anadromous Fisheries Restoration Program (AFRP) Working Paper (USFWS 1995), and Final Restoration Plan (USFWS 2001).

Martin et al. (2001) stated that RBDD was an ideal location to monitor juvenile winter Chinook Salmon production because (1) the spawning grounds occur exclusively above RBDD (Vogel and Marine 1991; Snider et al. 1997, USFWS 2011), (2) multiple traps could be attached to the dam and sampled simultaneously across a transect, and (3) operation of the dam could control channel morphology and hydrological characteristics of the sampling area providing for consistent sampling conditions for measuring juvenile fish passage.

[1] The National Marine Fisheries Service first listed Winter-run Chinook Salmon as threatened under the emergency listing procedures for the ESA (16 U.S.C.R. 1531-1543) on August 4, 1989 (54 FR 32085). A proposed rule to add winter Chinook Salmon to the list of threatened species beyond expiration of the emergency rule was published by the NMFS on March 20, 1990 (55 FR 10260). Winter Chinook Salmon were formally added to the list of federally threatened species by final rule on November 5, 1990 (55 FR 46515), and they were listed as a federally endangered species on January 4, 1994 (59 FR 440).

Since 2002, the USFWS RST winter Chinook Salmon juvenile production indices (JPI's) have been used in support of production estimates generated from carcass survey derived adult escapement data using NMFS' Juvenile Production Estimate (JPE) Model. Since 2014, the RBDD winter Chinook Salmon fry-equivalent JPI has been used as the basis of the NMFS' JPE Model. Moreover, RBDD JPI's are compared to adult escapement to evaluate adult spawning success in relationship to annual Sacramento River water temperature and flow management plans.

Fall, late-fall, spring, and winter Chinook Salmon and steelhead/Rainbow Trout (*Oncorhynchus mykiss*) spawn in the Sacramento River and tributaries upstream of RBDD throughout the year, resulting in year-round juvenile salmonid passage (Moyle 2002). Sampling of juvenile anadromous fish at RBDD allows for year-round quantitative production and passage estimates of all runs of Chinook Salmon and steelhead/Rainbow Trout. Timing and abundance data have been provided in real-time for fishery and water operations management purposes of the CVP since 2004[2]. Since 2009, 90% confidence intervals, indicating uncertainty in weekly passage estimates, have been included in real-time bi-weekly reports to allow better management of available water resources and to reduce impact of CVP operations on both federal Endangered Species Act (ESA) listed and non-listed salmonid stocks. Currently, Sacramento River winter Chinook Salmon are ESA-listed as endangered and Central Valley spring Chinook Salmon and Central Valley steelhead (hereafter *O. mykiss*) are listed as threatened.

Incidental capture of Green Sturgeon (*Acipenser medirostris*) and various lamprey species (*Entosphenus spp.* and *Lampetra spp.*) has occurred throughout juvenile Chinook Salmon monitoring activities at RBDD since 1995 (Gaines and Martin 2002). Rotary traps were designed to capture out-migrating salmonid smolts, yet data from the incidental capture of sturgeon and lamprey species has become increasingly relied upon for basic life-history information and as a measure of relative abundance and species trend data. The Southern Distinct Population Segment of the North American Green Sturgeon was listed as threatened under the Federal ESA on June 6, 2006. Pacific Lamprey (*Entosphenus tridentatus*) are thought to be extirpated from at least 55% of their historical habitat and have been recognized by the USFWS as a species needing a comprehensive plan to conserve and restore these fish (Goodman and Reid 2012 & 2018).

The objectives of this annual progress report are to: (1) summarize the estimated abundance of all four runs of Chinook Salmon and *O. mykiss* passing RBDD for brood year (BY) 2022 and 2023, (2) define temporal patterns of abundance for all anadromous salmonids passing RBDD, (3) correlate juvenile salmon production with adult salmon escapement estimates (where appropriate), (4) describe various life-history attributes of anadromous juvenile salmonids produced in the upper Sacramento River as determined through long-term

[2] Real-time passage estimates located on SacPAS: Central Valley Prediction & Assessment of Salmon: Red Bluff Juvenile Estimates Daily Graph Query with Biweekly Totals

monitoring efforts at RBDD, and (5) estimate annual relative abundance of Green Sturgeon and lamprey species.

This progress report addresses, in detail, USFWS juvenile anadromous fish monitoring activities at RBDD for the period January 1, 2022 through November 30, 2024. This report includes JPI's for the 2022 and 2023 brood year emigration period for the four runs of Chinook Salmon, passage estimates of *O. mykiss* and relative abundance indices for Green Sturgeon and lamprey spp. in the Sacramento River and is submitted to the US Bureau of Reclamation to comply with contractual reporting requirements for funds received through the Fish and Wildlife Coordination Act of 1934 under Interagency Agreement No. R15PG00067.

Study Area

The Sacramento River originates in northern California near Mt. Shasta from the springs of Mt. Eddy (Hallock et al. 1961). It flows south through 600 kilometers (km) of the state draining numerous slopes of the Coast, Klamath, Cascade, and Sierra Nevada ranges and eventually reaches the Pacific Ocean via San Francisco Bay (Figure 1). Shasta Dam and its associated downstream flow regulating structure, Keswick Dam, have formed a complete barrier to upstream anadromous fish passage since 1943 (Moffett 1949). The 95 river kilometer (RK) reach between Keswick Dam (RK 486) and RBDD (RK 391) supports areas of intact riparian vegetation and largely remains unobstructed. Within this reach, several major tributaries to the Sacramento River upstream of RBDD support various Chinook Salmon spawning populations. These include Clear Creek and Cottonwood Creek (including Beegum Creek) on the west side of the Sacramento River and Cow Creek, Bear Creek, Battle Creek and Payne's Creek on the east side (Figure 1). Below RBDD, the river encounters greater anthropogenic impacts as it flows south to the Sacramento-San Joaquin Delta. Impacts include, but are not limited to, channelization, water diversion, agricultural and municipal run-off, and loss of associated riparian vegetation.

RBDD is located approximately 3 kilometers southeast of the city of Red Bluff, California (Figure 1). The RBDD is 226 meters (m) wide and composed of eleven, 18-m wide fixed-wheel gates. Between gates are concrete piers 2.4-m in width. The USBR's dam operators were able to raise the RBDD gates allowing for run-of-the-river conditions or lower them to impound and divert river flows into the Tehama-Colusa and Corning canals. USBR operators generally raised the RBDD gates from September 16 through May 14 and lowered them May 15 through September 15 during the years 2002-2008. As of spring 2009, the RBDD gates were no longer lowered prior to June 15 and were raised by the end of August (or earlier) in an effort to reduce the impact to spring Chinook Salmon and Green Sturgeon (NMFS 2009). Since fall 2011, the RBDD gates have remained in the raised position due to the construction of a riverside pumping facility and fish screen (NMFS 2009). Adult and juvenile anadromous fish currently have unrestricted upstream and downstream passage through this reach of the Sacramento River. The RBDD conveyance facilities were relinquished to the Tehama Colusa Canal Authority (TCCA) by USBR as of spring 2012. The RBDD gates were permanently raised and infrastructure

decommissioned in 2015 leaving the transect location vulnerable to periodic changes in channel morphology under run-of-the-river conditions.

Methods

Sampling gear. Prior to June 30, 2020, sampling was conducted along a transect using (3) to (4) 2.4-m diameter RSTs (E.G. Solutions® Corvallis, Oregon) attached via aircraft cables directly to RBDD. The horizontal placement of rotary traps across the transect varied throughout the study period but generally sampled in the river-margins (east and west) and mid-channel habitats simultaneously (Figure 2). RSTs were positioned within these spatial zones unless sampling equipment failed, river depths were insufficient (< 1.2 m), or river hydrology restricted our ability to sample with all traps (water velocity < 0.6 m/s).

Changes in river channel morphology following the decommissioning of the RBDD gates in 2011 currently influence river depths across the RST transect. Substrate aggradation created insufficient river depths across many gates during periods of low flows (e.g., < 5kcfs). Insufficient depths lead to equipment damage and/or failure when 2.4-m RST cones contact river substrates. Oftentimes, RST cones created their own depression in the river bottom, which allowed for continued sampling, but in some instances resulted in conditions unfit to sample. Beginning on July 1, 2020, (4) 1.5-m diameter RSTs were used in concert with (1) 2.4-m RST, lending flexibility to sample a total of either (4) or (5) traps across the transect.[3]

Sampling regimes. In general, RSTs sampled continuously throughout 24-hour periods and samples were processed once daily[4]. During periods of high fish abundance, elevated river flows, or heavy debris loads, traps were sampled multiple times per day, continuously, or at randomly generated periods to reduce incidental mortality. When abundance of Chinook Salmon was very high, sub-sampling protocols were implemented to reduce take and incidental mortality of listed species in accordance with NMFS' ESA Section 10(a)(1)(A) research permit terms and conditions. The specific sub-sampling protocol implemented was contingent upon the number of Chinook Salmon captured or the probability of successfully sampling various river conditions. Initially, RST cones were structurally modified to sample one-half of the normal volume of water entering the cones (Gaines and Poytress 2004). If further reductions in capture were necessary, the number of traps sampled was reduced from four to three or after June 30, 2020, from five to four. During storm events and associated elevated river discharge levels, each 24-hour sampling period was divided into six or eight non-overlapping strata and one or two strata were randomly selected for sampling (Martin et al 2001). Estimates were extrapolated to un-sampled strata by dividing catch by the strata-selection probability (i.e., P = 0.25 or 0.17). If further reductions in effort were needed or river conditions were intolerable, sampling was discontinued or not conducted.

[3] Sampling of (4) 1.5 m and (1) 2.4 m RST is equivalent to sampling 87.5% volume of (4) 2.4 m RST's.
[4] 24-hr sample periods were defined as beginning at 07:00 on day 1 and ending at 06:59 on day 2.

Weekly rotary trap sampling effort was quantified by assigning a value of 1.00 to a week consisting of (4) 1.5-m diameter and (1) 2.4-m diameter traps collecting samples 7 days per week. Weekly values <1.00 represented occasions when less than all traps were sampling, one or more traps were structurally modified to sample only one-half the normal volume of water, or when less than 7 days per week were sampled. When days within a week were not sampled, daily passage for the sampled days within the week were averaged and imputed for unsampled days. If weeks or months were not sampled, passage estimates were imputed for missed days based on the concurrent number of week(s) or month(s) prior to and following the missed sample period.

Data collection. All fish captured were anesthetized, identified to species, and enumerated with fork lengths (FL) measured to the nearest millimeter (mm). When capture of Chinook Salmon juveniles exceeded approximately 200 fish/trap, a random sub-sample of the catch was measured to include approximately 100 individuals, with all additional fish being enumerated and recorded. Chinook Salmon race was field assigned using length-at-date (LAD) criteria developed by Greene (1992)[5]. Fin clips of juvenile salmonids >34 mm FL were sampled at a maximum rate of 10 fish, per run, per day for genetic analyses (Appendix A) and potential run identification corrections.

Green Sturgeon and lamprey species were measured for total length (TL) to the nearest mm. Identification of Green Sturgeon juveniles was possible based on meristic traits for individuals > 46 mm TL. Larval fish <46 mm were identified to genus, but assumed to be Green Sturgeon based on spawning adult species distribution data (Poytress et al. 2015; Mora et al. 2018). Lamprey species were identified to the genus level during the ammocoete stage. Adults and macrophthalmia (eyed juveniles) were identified to the genus and species level using dentition patterns, specifically by the number of inner lateral horny plates on the sucking disk (Moyle 2002).

Other data collected at each trap servicing included: length of time sampled, velocity of water immediately in front of the cone at a depth of 0.6 m (2.4-m diameter cone) or 0.37 m (1.5-m diameter cone), and depth of cone 'opening' submerged. Water velocity was measured using a General Oceanic® Model 2030 flowmeter. These data were used to calculate the volume of water sampled by traps (X). The percent river volume sampled by traps (%Q) was estimated as the ratio of river volume sampled to total river volume passing RBDD. River volume (Q) was obtained from the California Data Exchange Center's Bend Bridge gauging station at RK 415 (USGS site no. 11377100, http://waterdata.usgs.gov/usa/nwis/uv?site_no=11377100). Daily river volume at RBDD was adjusted from Bend Bridge river flows by subtracting daily TCCA diversions, when diversions occurred.

Mark-recapture trials. Chinook Salmon collected as part of daily samples were marked with Bismarck brown staining solution (Mundie and Traber 1983) prepared at a concentration

[5] Generated by Sheila Greene, California Department of Water Resources, Environmental Services Office, Sacramento (May 8, 1992) from a table developed by Frank Fisher, California Department of Fish and Game, Inland Fisheries Branch, Red Bluff (revised February 2, 1992). Fork lengths with overlapping run assignments were placed with the latter spawning run.

of 21.0 mg/L of water. Fish were stained for a period of 45-60 minutes, removed, and allowed to recover in fresh river water. Marked fish were held for 6-24 hours before being released approximately 4-km upstream from RBDD after official sunset. Trap efficiency was calculated based on the proportion of recaptures to total fish released (i.e., mark-recapture trials) within 24 hours of release. Trials were conducted as fish numbers and staffing levels allowed under a variety of river discharge levels and trap effort combinations.

Trap efficiency modeling. To develop gate-stratified trap efficiency models, mark-recapture trials were conducted as noted above. Trap efficiency for each gate (i.e., the proportion of the marked juvenile Chinook Salmon passing RBDD recaptured on day *d* at gate *i*; T_{di}) was modeled with the percent water volume sampled on day *d* at gate *i* ($\%Q_{di}$) to develop binomial generalized linear models (GLMs; eq. 2). Half-normal plots were used to identify outliers or influential observations that were subsequently excluded from fitting the binomial GLMs. The equations (slope β and intercept α) were then used to estimate the trap efficiency on day *d* at gate *i* ($\widehat{T_{di}}$) that was predicted from the percent water volume sampled on day *d* at gate *i* ($\%Q_{di}$).

Changes in river morphology since the winter of 2016 led to shallower conditions and increased trap efficiencies across the transect that were observed beginning in 2018. The BY2022 and 2023 passage and production estimates[6] employ the 44-trial hybrid-configuration trap efficiency models incorporating 24 trials conducted between 2020 and 2023 using the (4) 1.5-m and (1) 2.4-m RST array as well as 20 trials conducted during 2018 and 2019 using the former (4) 2.4-m RST array.

Daily passage estimates **($\widehat{P_d}$)**. The following procedures and formulae were used to generate daily and weekly estimates of total numbers of unmarked Chinook Salmon and *O. mykiss* passing RBDD. We define C_{di} as catch on day *d* (*d* = 1,…,*n*) at gate *i* (*i* = 1,…,*t*), and X_{di} as water volume sampled on day *d* (*d* = 1,…*n*) at gate *i* (*i* = 1,…*t*). The $\%Q_{di}$ was calculated from the ratio of water volume sampled (X_{di}) to river discharge (Q_d) on day *d* at gate *i*:

1. $\%Q_{di} = \frac{X_{di}}{Q_d}$

Trap efficiency ($\widehat{T_{di}}$) was estimated on day *d* at gate *i* from the binomial GLMs:

2. $\text{logit}\left(\widehat{T_{di}}\right) = \alpha + \beta(\%Q_{di})$

Daily trap efficiency was computed as:

3. $\widehat{T_d} = \sum_{i=1}^{t} \widehat{T_{di}}$

Daily salmonid catch was calculated as:

[6] BY 2020 and 2021 estimates were also recalculated within this report using the 44-trial GLMs. See Appendix B&C.

4. $C_d = \sum_{i=1}^{t} C_{di}$

Daily salmonid passage was estimated on day *d* (*d* = 1, …, *n*) as:

5. $\widehat{P_d} = \frac{C_d}{\widehat{T_d}}$

Weekly passage **($\hat{P}$)** ***and annual production*** **(JPI)**. Total numbers of Chinook Salmon and *O. mykiss* passing RBDD each week were computed from $\widehat{P_d}$ where there are *N* days within the week:

6. $\hat{P} = \frac{N}{n}\sum_{d=1}^{n} \widehat{P_d}$

Annual production (*JPI*) was estimated by summing $\hat{P}$ across weeks of the year:

7. $JPI = \sum_{1}^{52} \hat{P}$

Confidence intervals. A two-stage bootstrap algorithm was used to simulate sampling distributions of weekly passage $\hat{P}$ for the estimation of 95% confidence intervals (95% CIs). In the first stage that is associated with the variance of estimating daily passage from the same binomial GLMs of trap efficiency, parametric bootstrap replicates of binomial GLMs of trap efficiency were generated by randomly simulating binomial mark-recapture probabilities T_{di}^{*} from the probabilities predicted under the binomial GLMs ($\widehat{T_{di}}$), refitting the binomial GLMs of trap efficiency with the simulated probabilities with $\text{logit}\left(\widehat{T_{di}^{*}}\right) = \alpha + \beta(\%Q_{di})$, and re-estimating daily passage as $\widehat{P_d^{*}} = \frac{C_d}{\widehat{T_d^{*}}}$ from the bootstrap daily trap efficiency estimate $\widehat{T_d^{*}} = \sum_{i=1}^{t} \widehat{T_{di}^{*}}$. In the second stage which is associated with the variance of sampling days within the week, *n* bootstrap replicates of daily passage estimates $\widehat{P_d^{*}}$ were sampled with replacement to compute bootstrap replicates of weekly passage estimates with $\widehat{P^{*}} = \sum_{d=1}^{n} \widehat{P_d^{*}}$. The two-stage bootstrap algorithm was repeated 5,000 times, and 95% CIs for weekly passage estimates were obtained from the 2.5 and 97.5 percentiles of the empirical bootstrap distributions.

Empirical bootstrap distributions of annual passage (*JPI*) estimates were constructed by summing bootstrap replicates of weekly passage estimates across weeks of the year with $JPI^{*} = \sum_{1}^{52} \widehat{P^{*}}$. 95% CIs for annual passage estimates were drawn from the 2.5 and 97.5 percentiles of the empirical bootstrap distributions.

Relative abundance. Catch per unit volume (CPUV; Gaines and Martin 2002; Poytress et al. 2014) was used as an index of relative abundance (RA) for Green Sturgeon and lamprey species at RBDD.

15.

$$RA_{di} = \frac{C_{di}}{X_{di}}$$

RA_{di} = Relative abundance on day *d* by trap *i* (catch/acre-foot),
C_{di} = number of fish captured on day *d* by trap *i*, and
X_{di} = volume of water sampled on day *d* by trap *i*.

The volume of water sampled (X_{di}) was estimated for each trap as the product of one-half the cross sectional area (wetted portion) of the cone, water velocity (ft/s) directly in front of the cone at a depth of 0.6 m (2.4-m cone) or 0.37 m (1.5-m cone), cone modified (multiplied by 0.5) or not (multiplied by 1.0), and duration of sampling in minutes.

Fry-equivalent Chinook Salmon production estimates. The ratio of Chinook Salmon fry (<46 mm FL) to pre-smolt/smolts (>45 mm FL) passing RBDD was variable among years. Therefore, we standardized juvenile production by estimating a fry-equivalent JPI for among-year comparisons. Rotary trap JPI's could then be directly compared to determine variability in production between years. Fry-equivalent JPI's for spring, fall, and late-fall Chinook Salmon were calculated by summing the fry JPI and a weighted (1.7:1) pre-smolt/smolt JPI (inverse value of 59% fry-to-pre-smolt/smolt survival; Hallock undated).

A run-specific, annually calculated fry-to-smolt survival hindcast estimate based on O'Farrell et al. (2018) was employed for winter Chinook Salmon in 2022 and 2023 as the best available science. This survival estimate was employed, as recommended by the Interagency Ecological Program's Winter-Run Project Work Team, to produce a winter Chinook Salmon juvenile production estimate to guide incidental take at the Sacramento-San Joaquin Delta pumping facilities in 2020 (NMFS 2022). O'Farrell's method sums fry JPI and a weighted (2.022:1) pre-smolt/smolt JPI (inverse value of 49.465% fry-to-pre-smolt/smolt survival) for estimation of BY2022 winter Chinook Salmon fry-equivalents. O'Farrell's method sums fry JPI and a weighted (1.974:1) pre-smolt/smolt JPI (inverse value of 50.659% fry-to-pre-smolt/smolt survival) for estimation of BY2023 winter Chinook Salmon fry-equivalents. All BY2022 and 2023 winter Chinook Salmon fry equivalent production estimates reported within the following text, tables and graphics were calculated using O'Farrell's year-specific estimate of fry-to-smolt survival.

Egg-to-fry survival estimates. Annual juvenile winter and fall Chinook Salmon egg-to-fry (ETF) survival rates were estimated by calculating fry-equivalent JPI's and dividing by the estimated number of eggs deposited in-river. Winter Chinook Salmon adult data were derived from carcass survey estimates (D. Killam, CDFW, personal communication). Fall Chinook Salmon female spawner data were estimated using adult escapement estimates derived from the California Department of Fish and Wildlife's (CDFW) Grandtab data set (Azat 2024) and calculating female spawners based on sex ratios obtained from Coleman National Fish Hatchery (CNFH). Average female winter Chinook Salmon fecundity data were obtained from the Livingston Stone National Fish Hatchery (LSNFH) and fall Chinook Salmon fecundity estimates were obtained from CNFH annual spawning records.

Reducing bias associated with unmarked CNFH fall Chinook Salmon. Annual releases of 75% unmarked fall Chinook Salmon smolts from CNFH in the late winter to early spring months can positively bias weekly passage and annual production estimates of naturally produced spring and fall run Chinook Salmon (Voss and Poytress 2019). In most years, CNFH fall Chinook Salmon smolts are released at lengths that overlap with the spring Chinook Salmon LAD size category. Therefore, unmarked hatchery fish captures during and after CNFH fall Chinook Salmon production releases can affect fry-to-smolt size ratios, fry-equivalent values, and ETF survival rates for LAD spring or fall Chinook Salmon.

To reduce bias in spring and fall Chinook Salmon natural production and passage estimates, weekly passage estimates of *marked* (adipose fin clipped) hatchery fall Chinook Salmon assigned to spring or fall runs using LAD criteria were multiplied by a factor of 3 to coarsely approximate unmarked hatchery fish passage. These mark-corrected values were subtracted from unmarked Chinook Salmon weekly passage estimates for each run. If the weekly passage estimate of unmarked hatchery Chinook Salmon was greater than the unadjusted value, a value of zero was assigned for natural Chinook Salmon passage in those weeks.

Annual production was re-calculated after weekly passage was mark-corrected to adjust for unmarked hatchery Chinook Salmon, and 95% CIs for the mark-corrected annual production estimates were constructed from empirical bootstrap distributions of 100,000 replicates generated by sampling weekly mark-corrected passage estimates with replacement and computing mark-corrected annual production. The efforts to reduce bias associated with unmarked CNFH fall Chinook Salmon were made *post hoc* to mark-correct annual estimates and are not reflected in passage estimates reported within real-time biweekly reports or on SacPas. In summary, passage and production estimates for fall and spring Chinook Salmon herein are reported with the removal of hatchery fish (i.e., mark-corrected) in Tables 5,6,7, and 8 and Appendix Tables B3-B6. Fall and spring Chinook Salmon passage and production estimates for years 2020-2023 that were not mark-corrected for unmarked Chinook Salmon are reported in Appendix Tables C1-C8.

Results

Mark-recapture trials. Seven mark-recapture trials were conducted during this reporting period to estimate and validate RST efficiency using (4) 1.5-m and (1) 2.4-m RST's (Table 1). Three trials were conducted during the winter of 2023 using unmarked fall Chinook Salmon captured during the time period when unfed-fry were released upstream of RBDD by CNFH. An additional four trials using naturally produced winter Chinook Salmon were conducted in the fall of 2023 during peak capture periods. Two winter Chinook trials were excluded from further analyses due to interception of McCloud River origin marked winter Chinook that compromised the integrity of our mark-recapture efforts (Table 1).

The number of marked fish released per trial ranged from 853 to 1,499 (mean = 968) and the number of marked fish recaptured ranged from 24 to 81 (mean = 44; Table 1). Marked fish

were released after sunset and 96.5% of recaptures occurred within the first 24 hours, and 100% within 48 hrs. Randomly sub-sampled fork lengths of fish marked ranged from 32 to 66 mm (mean = 37.2 mm). Fork lengths of recaptured marked fish ranged from 32 to 65 mm (mean = 37.2 mm).

Fish collected and used for all trials were obtained from traps in all three spatial zones (east-margin, mid-channel and west-margin). The horizontal distribution of recaptured fish varied from the catch distribution of unmarked fish. The 8' RST in gate 6, or the thalweg, recaptured the highest proportion of marked fish as well as the most unmarked fish during all seven trials. Pearson's X-squared test with simulated p-value (based on 10,000 replicates) was used to test the null hypothesis of no difference in the proportions of marked fish among gates (Table 2). Results indicated a significant difference in the proportion of marked fish between gates (X-squared = 30.292, p-value = 2e-04).

The seven trials were conducted with unmodified cones (Table 1). Sacramento River discharge sampled during the seven trials ranged from 5,214 to 7,564 cubic feet per second (cfs). Estimated $\%Q_{di}$ during trap efficiency trials ranged from 2.17% to 3.13% (mean = 2.60%). Combined trap efficiency estimates for the seven trials ranged from 2.74% to 8.01% (mean = 4.50%).

Trap efficiency modeling. Five mark-recapture trials conducted during BY2023 using unmarked winter (n=2) and fall Chinook Salmon (n=3) were included in binomial generalized linear models (GLMs) of trap efficiency (Figure 3a). One to three outliers or influential observations per gate were identified with half-normal diagnostic plots and excluded from the binomial GLMs (Table 3). Likelihood ratio indices, also known as pseudo-R^2 (R^2_{McF}), were used to assess the goodness-of-fit of binomial GLMs and ranged from 0.02 (Gate 5) to 0.34 (Gate 6) (Figure 3a). The 44-trial binomial GLMs were employed for passage estimation for brood year 2022 and 2023 salmonids (Tables 4-15), but also for revised passage estimates for brood year 2020 and 2021 (See Appendix Tables B & C). All passage estimates reported herein used the 44-trial binomial GLMs (Figure 3a). Histograms of daily percent water volume sampled ($\%Q_{di}$) during WCS brood year 2022 and 2023 indicate that while the majority of $\%Q_{di}$ predictors fall within the range of interpolation of the response, a substantial portion of values require extrapolation below (10-75%) or above (0 to 5%; Figure 3b).

Winter Chinook Salmon fork length evaluations. BY2022 and 2023 juvenile winter Chinook Salmon fork lengths at capture ranged between 29 and 165 mm (Figure 4a & 5a). Winter Chinook Salmon were captured primarily (72.4%, 72.5%) in the fry size-class category (<46mm) with 96.6% and 94.6%, respectively, of those measuring less than 40 mm in BY 2022 and 2023. The other 27.4% and 27.5% were captured in the pre-smolt/smolt category (>45 mm) with 96.1% of the fish sampled between 46 and 100 mm in both BY2022 and 2023 (Figure 4a & 5a).

Genetic tissue samples from up to ten winter Chinook Salmon, according to LAD criteria, were collected daily as part of a genetic sampling project known as "Improving Vital Rates

Estimation Using Parentage-Based Mark Recapture Methods". In addition, samples from up to ten LAD spring Chinook Salmon per day were analyzed (see Appendix A) to evaluate the accuracy of field-based run assignments used to generate Chinook Salmon passage and production estimates. Genetic run assignment data indicated that winter Chinook Salmon were incorrectly assigned to spring Chinook Salmon using LAD criteria for a period of 20 days during BY2022, from October 16 through November 11, 2022 (Figure 6). Genetic evaluation for BY2023 indicated incorrect LAD assignment to spring Chinook Salmon occurred between October 16 and December 2, 2023 (Figure 7). Based upon genetic data, LAD spring Chinook Salmon were re-assigned to the winter Chinook Salmon category and included in the passage and production estimates with genetic corrections detailed in this report. Consequently, genetic re-assignment resulted in a net reduction for spring Chinook Salmon and in turn, an increase in winter Chinook Salmon passage and production estimates for BY2022 during weeks 42-46 (Table 4) and BY2023 during weeks 42-48 (Table 5).

Winter Chinook Salmon passage. BY2022 and 2023 total estimated winter Chinook Salmon juvenile passage at RBDD was 184,746 and 896,299 fry and pre-smolt/smolts combined, respectively (Table 4 & 5). Fry sized juveniles (<46 mm FL) comprised 54.9% and 64.2%, respectively of total BY2022 and 2023 estimated winter Chinook Salmon passage (Table 4 & 5). Fry passage occurred from July through the end of November (weeks 27 thru 47 & 48; Figure 8). Pre-smolt/smolt sized juveniles (>45 mm FL) comprised the reciprocal 45.1% and 35.8% of total BY2022 and 2023 passage estimates, respectively. First observed pre-smolt/smolt emigration past RBDD occurred in September (week 34 & 37; Table 4 & 5). Weekly pre-smolt/smolt passage estimates for the brood year concluded in mid-April in both years (week 16; Table 4 & 5; Figure 8).

Winter Chinook Salmon JPI to adult comparisons. The BY2022 winter Chinook Salmon fry-equivalent JPI was 269,901 juveniles (95% CI [227,870–314,461]; Table 4; Figure 8). The BY2023 winter Chinook Salmon fry-equivalent JPI was 1,208,714 juveniles (95% CI [1,071,748–1,364,795]; Table 5; Figure 8). Adult females contributing to in-river spawning of BY2022 and 2023 winter Chinook Salmon were estimated to have been 2,607 and 1,061 individuals (Table 6), respectively (D. Killam, CDFW, pers. comm.). The estimated ETF survival rates were 1.88% and 20.68%, based on the BY2022 and 2023 winter Chinook Salmon fry-equivalent JPI, estimated number of female spawners and estimated egg deposition in-river. The ETF survival estimates based on 95% CI's ranged from 1.6% to 2.2% for BY2022 and 18.3% to 23.4% for BY2023 (Table 6).

Adult female spawner estimates derived from winter Chinook Salmon carcass surveys and rotary-screw trap fry-equivalent JPI's from brood years 1996-2023 were used to evaluate the linear relationship between the estimates. Twenty-six observations were evaluated using the carcass survey data as the winter Chinook Salmon carcass survey did not start until 1996 and rotary trapping at RBDD was not conducted in 2000 and 2001. Rotary trap JPI's were significantly correlated in trend to adult female spawner estimates ($r^2 = 0.85$, $P < 0.001$, df = 25; Figure 9); however, BY2022's data point fell outside the prediction intervals of the regression

model. BY2023's data point fell very near, albeit slightly above, the line of best fit of the regression model (Figure 9).

Spring Chinook Salmon fork length evaluations. BY2022 and 2023 spring Chinook Salmon fork lengths at capture ranged between 31 and 148 mm (Figure 4b & 5b). Spring Chinook Salmon captures were weighted to the pre-smolt/smolt size-class category (>45 mm) with 59.3% in BY2022 and 95.3% in BY2023. Most of the spring Chinook Salmon captured in the pre-smolt/smolt category were between 46 and 100 mm comprising 94.0% and 96.3% of this size class in the two respective years. Spring Chinook Salmon fry measuring less than 40 mm accounted for 96.0% in BY2022 and 80.7% in BY2023 for those within the fry category and accounted for the reciprocal 40.7% and 4.7% of captures annually in BY2022 and BY2023 (Figure 4b & 5b).

Spring Chinook Salmon passage. Including genetic corrections and removal of unmarked hatchery smolts, BY2022 and 2023 spring Chinook Salmon mark-corrected juvenile estimated passage at RBDD was 66,631 and 127,165 fry and pre-smolt/smolts combined, respectively (Table 7 & 8). Fry sized juveniles (<46 mm FL) comprised 58.1% and 8.7% of total estimated spring Chinook Salmon passage in BY2022 and 2023. Fry passage occurred from mid-November through mid-January (weeks 46 thru 2; Table 7) in BY2022. Fry passage occurred from December to the beginning of January (weeks 49 thru 1; Table 8) in BY2023. Pre-smolt/smolt sized juveniles (>45 mm FL) comprised the reciprocal 41.9% and 91.3% of total passage in BY2022 and 2023, respectively (Table 7 & 8). Detection of pre-smolt/smolt passage for the brood year ended by July in both years (week 27; Table 7 & 8). Pre-smolt/smolt passage peaked during April and May in both years coinciding with CNFH fall production releases, irrespective of attempts to subtract estimated unmarked hatchery fish that exceeded fall run LAD size categories (weeks 12-19; Figure 10).

The fry-equivalent spring Chinook Salmon JPI for BY2022 was 86,010 juveniles (95% CI [42,764–137,109]; Table 7). The fry-equivalent spring Chinook Salmon JPI for BY2023 was 207,879 juveniles (95% CI [104,368–327,274]; Table 8). Spring Chinook Salmon ETF survival rates were not estimated due to inaccuracies with run designation and adult counts as noted in Poytress et al. (2014).

Fall Chinook Salmon fork length evaluations. BY2022 and 2023 fall Chinook Salmon fork lengths at capture ranged between 28 and 174 mm (Figure 4c & 5c). BY2022 and 2023 fall Chinook Salmon were composed of 50.5% and 40.0% in the fry size-class category (<46 mm) with 95.9% and 95.1% of individuals measuring less than 40 mm FL, respectively (Figure 4c and 5c). The reciprocal 49.5% and 60.0% of fall Chinook Salmon were captured in the pre-smolt/smolt category, were measured between 46 and 100 mm and comprised 95.7 and 96.6% within this category.

Fall Chinook Salmon passage. After subtraction of an estimated number of *unmarked* hatchery smolts, BY2022 and 2023 mark-corrected fall Chinook Salmon juvenile estimated

passage at RBDD was 3,615,743 and 1,865,876 fry and pre-smolt/smolts combined (Table 9 & 10). However, no attempts were made to adjust estimates due to releases of 2,766,360 unmarked, unfed-fry CNFH fall Chinook Salmon from fry, total or fry equivalent estimates (Table 9; Figure 11). Fry sized juveniles (<46 mm FL) in BY2022 and 2023, respectively, comprised 78.9% and 59.3% of total estimated fall Chinook Salmon passage (Table 9 & 10). Fry passage began in December and was detected through early to mid-April in both years. Fry passage appeared heavily influenced by the 2022 unfed-fry releases that occurred as evidenced by the three peaks in abundance noted in January and February (weeks 52-8; Figure 11). Pre-smolt/smolt sized juveniles (>45 mm FL) comprised the reciprocal 21.1% and 40.7% of total passage in BY2022 and 2023, respectively (Table 9 & 10). Pre-smolt/smolt passage peaked during April and May in both years coincident with CNFH fall production releases irrespective of attempts to subtract estimated unmarked hatchery fish (weeks 12-19; Figure 11).

Fall Chinook Salmon JPI to adult comparisons. The fry-equivalent rotary trap JPI for BY2022 was 4,145,785 juveniles (95% CI [2,174,959 – 6,577,717]; Table 9). The fry-equivalent rotary screw trap JPI for BY2023 was 2,393,991 juveniles (95% CI [1,496,008 – 3,424,235]; Table 10). The total number of estimated adult BY2022 and 2023 fall Chinook Salmon females contributing to in-river spawning upstream of RBDD was 5,541 and 2,892 in BY2022 and 2023 (Table 11), respectively. The estimated ETF survival rate was 15.32% and 14.71%, respectively, based on BY2022 and 2023 fall Chinook Salmon fry-equivalent JPI, estimated number of female spawners and estimated eggs deposited in-river. The ETF survival based on 95% CI's ranged from 8.0% to 24.3% for BY 2022 and 9.2% to 21.0% for BY2023 (Table 11).

Late-Fall Chinook Salmon fork length evaluations. BY2022 and 2023 late-fall Chinook Salmon at capture ranged between 29 and 187 mm (Figure 4d & 5d). Late-fall Chinook Salmon captures were skewed towards the pre-smolt/smolt size-class category (>45 mm) with 89.5% in BY 2022 and 95.6% in BY2023. The majority of the late-fall Chinook Salmon captured in the pre-smolt/smolt category were between 46 and 100 mm comprising 68.3% and 56.6% of this size class in the two respective years. Late-fall Chinook Salmon fry measuring less than 40 mm accounted for 88.9% in BY2022 and 90.5% in BY2023 for those within the fry category and accounted for the reciprocal 10.5% and 4.4% of captures annually in BY2022 and 2023 (Figure 4d & 5d).

Late-fall Chinook Salmon passage. BY2022 and BY2023 late-fall Chinook Salmon juvenile estimated passage at RBDD was 9,292 and 41,140 fry and pre-smolt/smolts combined (Table 12 & 13). Fry sized juveniles (<46 mm FL) comprised only 7.2% and 4.7% of total estimated late-fall Chinook Salmon passage (Table 12 & 13). BY2022 fry passage were detected from April through mid-June at very low levels of abundance (weeks 15-26; Figure 11). A similar pattern was exhibited by BY2023 late-fall Chinook Salmon fry passing from April to early June (weeks 15-23; Figure 11). Pre-smolt/smolt sized juveniles (>45 mm FL) comprised the reciprocal 92.8% in BY2022 and 95.3% in BY2023 of total passage with the first observed emigration past RBDD occurring in June in both years (Table 12 & 13). Weekly pre-smolt/smolt passage for both brood years ended primarily in January (week 4; Figure 11).

The fry-equivalent late-fall Chinook Salmon JPI for BY2022 was 15,281 juveniles (95% CI [11,576 – 19,276]; Table 12). The fry-equivalent late-fall Chinook Salmon JPI for BY2023 was 68,384 juveniles (95% CI [48,653 – 92,730]; Table 13). Late-fall Chinook Salmon ETF survival rates were not estimated due to inaccuracies in adult count data as noted in Poytress et al. (2014).

O. mykiss fork length evaluations. BY2022 and 2023 juvenile *O. mykiss* at capture were between 21 and 390 mm in fork length. BY2022 size class ratios of juveniles sampled included 10.6% fry (<41 mm), 85.2% sub-yearling (41-138 mm), 3.8% yearling (139-280 mm) and 0.4% 2-year-old fish (>280 mm). BY2023 size class ratios of juveniles sampled included 3.4% fry (<41 mm), 94.1% sub-yearling (41-138 mm), 2.1% yearling (139-280 mm) and 0.3% 2-year-old fish (>280 mm). *O. mykiss* yearlings were amongst the first sampled at the beginning of calendar year 2022 and 2023 (Table 14 & 15). *O. mykiss* fry (<41mm) captures were sporadic and few, with the first fry of the year captured in March of 2022 (Table 14) and February in 2023 (Table 15). Sub-yearlings, the dominant size class captured, were caught between March and December of 2022 (Table 14) and May and December in 2023 (Table 15).

O. mykiss passage. BY2022 *O. mykiss* juvenile total estimated passage at RBDD was 22,327 fry, sub-yearlings and yearlings up to 200 mm fork length combined (95% CI [19,963 – 24,739]; Table 14). BY2023 *O. mykiss* juvenile total estimated passage at RBDD was 49,542 fry, sub-yearlings and yearlings up to 200 mm fork length combined (95% CI [46,347 – 52,413]; Table 15). BY2022 *O. mykiss* total weekly passage peaked at 4,040 juveniles in week 16 of 2022 (Table 14; Figure 13). BY2023 *O. mykiss* total weekly passage peaked at 4,065 in week 32 of 2023 (Table 15) some 16 weeks later in the calendar year when compared to the peak in 2022 (Figure 13).

Green Sturgeon data. Sturgeon catch by rotary screw-traps in calendar year 2022 was composed of two juveniles with a mean total length of 100.5 mm (range = 89 – 112 mm; Figure 14a) during the month of September (Figure 14b). No larvae were sampled by in this year. Annual Green Sturgeon CPUV for 2022 was 0.02 fish/ac-ft (Table 16; Figure 14c).

Sturgeon catch in 2023 was primarily composed of recently emerged, exogenous feeding larvae with a median total length of 28.0 mm (Table 16). A total of 4,290 sturgeon were captured during calendar year 2023 ranging in length from 20 to 266 mm (Figure 14a). Green Sturgeon larval captures began in late May and continued through mid-August of 2023 (Figure 14b). Juvenile Green Sturgeon captures occurred in June as larval sturgeon began to develop morphometric features that could positively identify them as Green Sturgeon in the field. Juvenile captures >/= 50 mm in total length continued sporadically until the latter half of December and totaled 26 individuals. Annual Green Sturgeon CPUV for 2023 was 37.05 fish/ac-ft (Table 16; Figure 14c), the highest recorded CPUV estimate in 26 years of annual monitoring.

Lamprey species data. Capture of multiple lamprey species occurred in water year 2023 (WY2023; October 1, 2022 – September 30, 2023). Lamprey species sampled during WY2023 included Pacific Lamprey (*Entosphenus tridentata*), Western Brook Lamprey (*Lampetra*

richardsoni) and River Lamprey (*Lampetra ayresi*). Unidentified lamprey ammocoetes and Pacific Lamprey composed 96.4% of all lamprey spp. captures, 70.0% and 30.0% respectively. Ninety-six River Lamprey and five Western Brook Lamprey were captured during WY2023 making up the remaining 3.6% of annual lamprey captures.

Unidentified lamprey ammocoetes sampled during WY2023 totaled 1,916 individuals (Table 17) and ranged from a minimum total length of 19 mm to a maximum length of 197 mm (mean= 113 mm; Figure 15a). Annual catch of Pacific Lamprey was 822 (Table 17) and ranged from a minimum total length of 87 mm to a maximum total length of 470 mm (mean = 129 mm, Figure 16a).

Lamprey captures occurred throughout the water year, beginning in early October and continuing through the end of September (Figures 15b and 16b). Lamprey CPUV for WY2023 was 37.0 fish/ac-ft (Table 17, Figure 15c) for unidentified lamprey ammocoetes and 37.6 fish/ac-ft for Pacific Lamprey (Table 18, Figure 16c). The WY2023 unidentified lamprey ammocoete abundance estimate was above the 9-year mean CPUV value of 28.1 ± 21.6 fish/ac-ft (Table 17). The WY2023 Pacific Lamprey mean value was much lower than the highly variable 9-year mean CPUV value of 188.0 ± 248.7 fish/ac-ft (Table 18).

Discussion

Trap efficiency model updates. A new (4) 5’ and (1) 8’ RST array has been in operation since the project resumed operations in July of 2020 following COVID-19 pandemic workplace restrictions. Changes with channel configuration in the absence of RBDD operations and decreases in channel water depths at the site following significant run-off events or wet water years (e.g., 2016 and 2019) required that we sample in many gates with smaller 5’ diameter cones over the standard 8’ cones used since 1995 (Gaines and Martin 2002, Voss and Poytress 2022). The linear regression model that had been employed consistently until 2020 was validated annually, but beginning in 2018 appeared to underestimate trap efficiencies (thereby potentially inflating passage estimates) compared to some in-season trial data. This trend of underestimating modeled efficiencies relative to annual mark-recapture trial results continued in 2020 with the employment of the new hybrid trap configuration that was implemented for the reduced channel depths found after the numerous storms, resultant high runoff rates and subsequent channel aggradation which occurred in 2019. As a stop-gap measure to continue producing real-time passage estimates, the linear model was modified to incorporate only the most recent mark-recapture trials from 2018 through 2020 using trap-caught winter and fall Chinook Salmon. This was done while new efficiency data from the (4) 5’ and (1) 8’ trap configuration were collected and added to a new hybrid 5’ and 8’ based RST efficiency linear regression model (Voss and Poytress 2023).

Following extensive trap efficiency model analyses between 2022 and 2024 and relative to the changes in site and trapping operations, it became imperative that a new model structure be constructed and evaluated. Incorporating mark-recapture trials conducted

between 2018 and 2023 (n=44) and trap-specific binomial GLMs (Figure 3) allows for the use of 5' or 8' cones in any gates typically sampled (1,5,6,7,8) to allow for flexibility in sampling operations while providing more accurate trap efficiency results. The 44 trials consist of 20 trials with 8' rotary traps in 2018-2020 (Voss and Poytress 2022) as well as 24 trials conducted using the newer (4) 5' and (1) 8' hybrid cone configuration that has been in use since 2020 (Voss and Poytress 2023). The new binomial GLMs method more accurately predicts individual trap efficiencies, specific to data collected when 5' or 8' cones are in use, to provide more realistic trap array efficiencies when combined on a daily basis. The flexibility afforded by this individual trap-efficiency approach should allow the project to continue as the Sacramento River at the RBDD site changes relative to channel depths and velocities.

The new gate-specific binomial GLM method will be improved with increased trap efficiency data points from additional mark-recapture trials using variable placements of 5' and 8' RST. For instance, the binomial GLM for Gate 6 includes only 8' RST trials and the Gate 5 GLM only has 5' RST trials, therefore the addition of trap efficiencies from mark-recapture trials with a 5' RST in Gate 6 and an 8' RST in Gate 5 will expand the range of interpolation for trap efficiency estimates (Figure 3). Furthermore, simply increasing the number of trap efficiency trials used in fitting the binomial GLMs should improve the models for all gates.

Patterns of abundance. BY2022 and 2023 winter Chinook Salmon fry out-migrants comprised 55% and 64%, respectively of total estimated winter Chinook Salmon passage (Table 4 & 5) with pre-smolt/smolts representing the remaining 45% and 36%. The BY2022 value is the lowest fry to smolt ratio relative to abundance which was also the lowest recorded value in 27 years of monitoring. The BY2023 value fell within the bottom 1/3, but near the mean value of 66% for abundance estimates of winter Chinook Salmon that are below 1 million juveniles. Trap sampling effort relative to passage estimation averaged 81% and 82% for BY2022 and 2023, respectively. Fall trap sampling effort during the primary juvenile winter Chinook Salmon capture period was relatively high at 85% and 94% due to the mostly regulated fall river conditions in each of those years (Table 4 & 5; Figure 17). Sampling effort during the winter and spring were modest at 76% and 70% for BY2022 and 2023 (Table 4 and 5). Overall, imputation for reduced trap sampling effort accounted for 12.9% of the total BY2022 estimate of 184,746 and 3.5% of the total BY2023 estimate of 896,299 winter Chinook Salmon passing the RBDD.

Genetic sub-sampling results indicated that field-assigned LAD BY2022 and 2023 spring Chinook Salmon prior to November 12, 2022 and December 2, 2023, respectively, were genetically assigned to be winter Chinook Salmon. Subsequently, when incorporating genetic corrections into passage estimates, for BY2022 and 2023 winter Chinook Salmon, the addition of LAD spring Chinook Salmon genetic reassignments (October 16 thru November 11 and December 1, respectively) resulted in a modest net increase of 4.5% and 11.4% to the BY2022 and 2023 passage estimates, respectively.

Capture of BY2022 and 2023 juvenile spring Chinook Salmon began on October 16 of each year, according to LAD criteria. As noted above, genetic assignment results indicated genetic

spring Chinook Salmon were first collected on November 11, 2022 and December 1, 2023. Winter and spring Chinook Salmon estimates were both genetically corrected, accordingly. Trap sampling effort relative to passage estimation was moderately high throughout the BY2022 and 2023 averaging 83.6% and 80.4%, respectively. Sampling effort during the first half (winter period) of each brood year was lower, averaging 72.9% and 69.1%, as compared to the second half (summer period), which averaged 94.3% and 91.7% (Table 7 and 8), respectively. The first half of each year necessitates reduced sampling effort primarily due to CNFH fall Chinook Salmon production releases, but also due to winter storms (Table 19 and 20; Figure 17).

Spring Chinook Salmon total passage in BY2022 was nearly equal in ratio between fry (58%) and smolts (42%; Table 7), whereas in BY2023 smolts dominated the ratio (9:91%; Table 8). BY2022 passage was estimated to be approximately half the total of BY2023 and the numerical differences are likely a result, in part, due to the differences in timing of CNFH fall Chinook Salmon production releases. March releases appear to impact spring Chinook Salmon capture (Table 19) and resultant passage estimates more than April or May releases (Table 20). Mark-corrections for unmarked CNFH fall Chinook Salmon that appear in the spring Chinook Salmon LAD category from March release strategies decrease spring Chinook Salmon passage estimates but are not absolute, as increases in capture rates (and passages estimates) are still detected regardless of mark-correction estimation procedures. Appendix Tables C5 & C6 are available to compare between unmarked spring Chinook Salmon passage estimates with mark-corrected spring Chinook Salmon passage estimates (Table 7 & 8; Figure 10).

Fall Chinook Salmon fry passage accounted for 79% of the total passage for BY2022. Trap sampling effort was moderately high in the first half of the brood year, averaging 0.84 but fry passage (Table 9) was largely influenced by three unfed-fry releases by CNFH (totaling 2,766,360 fry) upstream of RBDD at RK 445 (during weeks 1 through 5; Table 19; Figure 11). The unfed-fry, assuming zero mortality, could have accounted for nearly 97% of all fall Chinook Salmon fry estimated to have passed RBDD in BY2022. This is not entirely reasonable as BY2022 peak fry capture and the associated weekly passage estimate of 725,899 occurred in week 52 (Table 9) the week *prior* to the first unfed-fry release. Overall, the unfed-fry add uncertainty to the fry, total passage, production and associated ETF estimates for BY2022.

Fall Chinook Salmon passage in the pre-smolt/smolt size category comprised 21% of the BY2022 total passage estimate (Table 9). Average trap sampling effort during the smolt passage period was very high (0.96) with periods of reduced effort due to hatchery releases. The March CNFH BY2022 fall Chinook Salmon release timing resulted in many hatchery-origin fall Chinook Salmon being categorized as spring Chinook Salmon according to LAD criteria which had the inverse effect of reducing fall Chinook Salmon passage estimates for BY2022 mark-corrected and uncorrected passage estimates. Overall, the BY2022 total passage estimate was the 3rd lowest point estimate for any fall Chinook Salmon brood year in the last 27 years of sampling at RBDD. Temperature dependent mortality (TDM) is not modeled or estimated for fall Chinook Salmon, but river temperatures may have impacted egg survival in the upper Sacramento River in 2022 (Figure 17). Thiamine deficiency complex (TDC) was estimated to have "impacted"

82.9% and "likely impacted" an additional 12.2% or 95.1% of the total fall Chinook Salmon eggs sampled for Thiamine concentration at CNFH in 2022 (salmon_thiamine/hatchery_ccv).

Fall Chinook Salmon fry passage accounted for 59% of the total passage for BY2023. Trap sampling effort was moderately high in the first half of the brood year, averaging 0.80. Fall Chinook Salmon passage in the pre-smolt/smolt size category comprised 41% of the BY2023 total passage estimate (Table 10). Average trap sampling effort during the smolt passage period was high (0.90) with periods of reduced effort due to hatchery releases. The timing of CNFH fall Chinook Salmon released in BY2023 resulted in most fall Chinook Salmon being categorized as fall Chinook Salmon according to LAD criteria which had the effect of increasing fall Chinook Salmon passages estimates for mark-corrected (Table 10) and uncorrected BY2023 passage estimates. Appendix Tables C7 & C8 are available to compare between unmarked and mark-corrected fall Chinook Salmon passage estimates (Table 9 & 10; Figure 11).

The BY2023 fall Chinook Salmon total passage estimate (Table 10) and fry-equivalent production estimate (Table 11) were the 2nd lowest brood year estimates in the last 27 years of sampling at RBDD. ETF was 14.71% which was within one standard deviation and above the mean of 12.64%. TDM likely had a minimal effect on egg survival due to suitable water temperatures (Figure 17). TDC was estimated to have "severely impacted" 20.0%, "impacted" 53.3% and "likely impacted" an additional 6.7% or 80.0% of the total fall Chinook Salmon eggs sampled for Thiamine concentration at CNFH in the fall of 2023 (salmon_thiamine/hatchery_ccv).

Late-fall Chinook Salmon passage for BY2022 and 2023 was dominated by those in the pre-smolt/smolt size category, which comprised 93% and 95% of total brood year passage (Table 12 & 13). Trap sample effort was reduced during March, April and May during CNFH fall Chinook Salmon releases which reduced sampling effort during late-fall Chinook Salmon fry emergence (Table 19 & 20). Trap sampling effort overall during the two brood years was similar and moderately high at 0.80 and 0.82, respectively. Total passage for BY2022 was the lowest recorded value in the last 27 years of sampling. BY2023 passage was ranked 3rd lowest if BY2020 is excluded, since the first 3 months of late-fall emergence were not sampled in that year due to COVID-19 workplace restrictions.

O. mykiss passage varied considerably between CY2022 and CY2023 with total passage estimated at 22,237 and 49,542 juveniles (Table 14 & 15), respectively. The temporal distribution pattern between CY2022 and CY2023 varied substantially with peak passage in April and May in the dry year of 2022 and July to August during the wet year of 2023 (Figure 13); the latter pattern a more typical distribution pattern (Poytress et al. 2014). Differing river conditions between years appears to have affected both the timing of spawning and amount of spawning or at least the timing of migration of juveniles relative to our total estimated passage estimates.

CY2022 and CY2023 Green Sturgeon catch and relative abundance indices were extremely varied between the two years with the lowest catch (above zero) in 2022, a critically dry water

year, but the highest CPUV ever recorded in 2023 (Table 16), a wet water year. No larval sturgeons were sampled in 2022 (Figure 14a). Two juveniles, between 89 and 112-mm total length (Table 16), were captured the morning of September 21, 2022, following a high turbidity event (runoff event from fire-affected area in Cottonwood Creek) peaking at 587.9 NTU (171.9% increase) the prior evening on September 20, 2022. These juvenile captures are consistent with results obtained by Poytress et al. (2024) whereby increases in turbidity between 102.0 and 424.6% were associated with juvenile Green Sturgeon migration initiation. Flow rates increased a miniscule 6% over ambient conditions resulting in a rare observation when substantial increases in turbidity alone were sufficient to cue the migration or movement of juvenile Green Sturgeon.

CY2023 Green Sturgeon catch was the 3rd highest of all years sampled, but the highest index of relative abundance in 27 years of sampling (Gaines and Martin 2002; Poytress et al. 2014, Voss and Poytress 2023). The highest level of relative abundance, yet 3rd ranking year of catch rates was a result of the standardization of effort between the current (4) 5' and (1) 8' RST array over the prior (4) 8' RST array used until March 2020. The current hybrid array samples 87.5% of the volume of the former array. Lower catch when standardized to fish caught per acre-foot of water volume sampled results in higher relative abundance indices when compared with the former array.

Lamprey ammocoetes and Pacific Lamprey macrophthalmia catch and relative abundances were inversely related between catch rates (and CPUV) and water years between WY2022 and 2023 (Table 17 & 18). Catch and relative abundance of Pacific Lamprey was an order of magnitude greater in WY2022 as compared to 2023 yet catch and CPUV of lamprey ammocoetes was greater in WY2023 over 2022 (Figures 15 & 16).

Winter Chinook Salmon JPI and ETF survival estimate. The BY2022 winter Chinook Salmon fry-equivalent JPI value of 269,901 was the lowest JPI value in the 27-year history of the project and 39% lower than the prior lowest value of 440,951 in 2015. The BY2023 winter Chinook Salmon fry-equivalent JPI value of 1,208,714 was the eighth lowest value and 31% below the geometric mean of the last twenty-two years of data collection on juvenile winter Chinook Salmon at RBDD. Adult female escapement for BY2022 (n=2,607) ranked fifth and for BY2023 (n=1,061; Table 6) twelve in the last twenty-two years of carcass surveys. The fry-equivalent JPI based ETF survival rate for BY2022 was estimated at 1.88% and 20.68% for BY2023, respectively (Table 4). The BY2022 value was nearly identical to the lowest value of 1.86% estimated in BY2021 and fell well below the 22-year average ETF survival estimate of 21.2%. In contrast the BY2023 ETF estimate of 20.68% was very similar to the 22-year average estimate.

WY2022 was designated as critically dry for the Sacramento Valley according to the WY Hydrologic Classification Index (WSIHIST). Shasta Reservoir cold-water pool storage conditions were described as Tier 4 in WY 2022; meaning there was an insufficient cold-water pool to maintain a daily average temperature of 56˚F or lower at the Clear Creek mouth river (CCR) gauge for the duration of the entire temperature management season (USBR 2022). After input

from various agencies and stakeholders, a temperature control strategy of maintaining 56˚F using the Highway 44 Bridge (SAC) gauge as the compliance point was developed with numerous criteria and approaches to minimize modeled TDM. The final Temperature Management Plan for 2022 established criteria to target temperatures of 58˚F for holding adults in the early part of the spawning season and then to target 54.5˚F from June 7 through September 27 (critical egg incubation period) or until the cold-water pool was exhausted in an attempt to preserve winter Chinook Salmon redds. The pre-season stage independent TDM (Martin et al. 2017) estimate was 54% (NMFS 2022). The NMFS hindcast estimates indicated an observed or final TDM estimate of 16% (NMFS 2023).

Increased water temperatures contributed to the record low winter Chinook Salmon ETF survival for BY2022, but TDC also appeared to have contributed significantly to low ETF survival. Average egg mortality due to TDC was modeled at 51% (range = 44 to 58%) with an estimated 96.5% of all eggs sampled being affected (egg Thiamine concentration < 8 nmol g^{-1}) and deemed "severally impacted" (42.9%) or "impacted" (53.6%) for BY2022 winter Chinook Salmon which compounded the 16% TDM estimates of mortality (M. Daniels, NMFS, unpublished data).

From mid-September to early November of 2022, the RBDD RSTs were sampled for wild winter Chinook Salmon to determine the prevalence and severity of infection of internal and external parasites, like previous years. USFWS' California-Nevada Fish Health Center performed histological analyses on 40 fish samples with a focus on the internal parasites *Ceratonova shasta* and *Parvicapsula minibicornis*. *C. shasta* was observed within the intestine of 13% of the sample group (5/40 fish; categorized as "early stage") and *P. minibicornis* was observed in the kidney of 41% of the sample group (14/37 fish categorized as "early stage" and 1 fish rated as "parasite present with inflammation"; Foott 2022a). Additional findings included 4 with trematodes observed in the intestinal lumen and coagulated yolk in 5 fish samples, which has occurred historically in hatchery winter Chinook Salmon fry. Some moribund winter Chinook Salmon fry observed in November of 2022 at LSNFH had low condition factor, abnormal gill, intestine and liver coloration from which abnormal yolk protein metabolism appeared to be the primary driver of morbidity (Foott 2022b). While prevalence of infection of winter Chinook Salmon sampled from the RBDD RSTs may be seen as concerning, the severity of "diseased" state winter Chinook Salmon for *C. shasta* (13%) and *P. minibicornis* (3%) is not alarming, but coupled with other in-season observations of fry abnormalities at the hatchery, certainly could have contributed to additional losses of natural production within the upper Sacramento River in 2022.

WY2023 was designated as wet according to the WY Hydrologic Classification Index (WSIHIST). Shasta Reservoir cold-water pool storage conditions were described as Tier 1 in WY 2023; meaning there was sufficient cold water to maintain a daily average temperature of 53.5˚F or lower at the CCR gauge for the duration of the entire temperature management season (USBR 2023). Pre-season stage independent TDM (Martin et al. 2017) and stage-dependent TDM (Anderson et al. 2022) estimates were 0.0% (USBR 2023). The NMFS hindcast

estimates indicated an observed or final TDM estimate of 0.0% (M. Daniels, NMFS, pers. comm).

Water temperatures during spawning and incubation in the Sacramento River were not estimated to negatively impact BY2023 winter Chinook Salmon ETF survival. Histopathology samples were not collected due to a perceived lack of need considering the good water temperature and flow conditions. TDC likely contributed significantly to lower-than-expected ETF survival of BY2023 winter Chinook Salmon given the favorable river conditions and higher than long-term average ETF estimates typical in wet water year types. Average egg mortality estimated for BY2023 winter Chinook Salmon due to TDC was modeled at 51% (range = 44 to 58%) with an estimated 88.1% of all eggs sampled being affected (egg Thiamine concentration < 8 nmol g^{-1}) and either "severally impacted" (54.2%) or "impacted" (33.9%) for BY2023 winter Chinook Salmon irrespective of the 0% TDM estimates of mortality (M. Daniels, NMFS, unpublished data).

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Tables

Table 1. Summary of results from mark-recapture trials conducted in 2023 (n=7) to evaluate rotary-screw trap efficiency at Red Bluff Diversion Dam (RK 391), Sacramento River, California. Results include the run of Chinook Salmon used, number of fish released, mean fork length at release (Release FL), number recaptured, mean fork length at recapture (Recapture FL), combined trap efficiency (TE%), percent river volume sampled by rotary-screw traps (%Q), number of traps sampling during trials, and modification status as to whether or not traps were structurally modified to reduce volume sampled by 50% (Traps modified).

Trial#	Year	Run	Number Released	Release FL (mm)	Number Recaptured	Recapture FL (mm)	TE (%)	%Q	Number of traps sampling	Traps modified
1	2023	fall	875	37.3	24	39.7	2.74	2.37	5	No
2	2023	fall	1,499	35.9	81	36.4	5.40	2.80	5	No
3	2023	fall	853	37.8	28	37.3	3.28	3.13	5	No
*4	2023	winter	886	35.6	71	35.6	8.01	2.53	5	No
*5	2023	winter	872	36.1	49	36.1	5.62	2.17	5	No
6	2023	winter	880	38.1	30	38.9	3.41	2.55	5	No
7	2023	winter	911	40.0	28	36.5	3.07	2.64	5	No

*Trial compromised due to capture of marked McCloud winter Chinook Salmon; not used in trap efficiency modeling.

Table 2. Contingency table of marked versus unmarked fish counts (based on a 24-hour recapture period) from 5 mark-recapture trials conducted in 2023. Pearson's X-squared test with simulated p-value (based on 10,000 replicates) was used to test the null hypothesis of no difference in the proportions of marked fish among gates. X-squared = 30.292, p-value = 2e-04.

Station Code	Count Marked	Count Unmarked	Proportion Marked
Gate 1	0	37	0.000
Gate 5	32	443	0.067
Gate 6	110	1,188	0.085
Gate 7	33	442	0.069
Gate 8	6	444	0.013

Table 3. Summary of mark-recapture trial results conducted between 2018 and 2023 (n = 44) used with the GLMs to evaluate rotary-screw trap efficiency at Red Bluff Diversion Dam (RK 391), Sacramento River, California. Trap efficiency (TE) and volume sampled (%Q_{di}) are based on a 24-hour recapture period.

		Gate 1		Gate 5		Gate 6		Gate 7		Gate 8	
Release Date	Release (n)	TE	%Q_{di}	TE	%Q_{di}	TE	%Q_{di}	TE	%Q_{di}	TE	%Q_{di}
10/9/2018	1177	-	-	-	-	0.000	1.050	0.023	1.110	0.007	1.040
10/11/2018	1247	-	-	-	-	*0.00	*1.22	0.014	0.990	0.014	0.990
10/17/2018	1147	-	-	-	-	0.000	0.620	0.005	0.940	0.014	1.070
12/28/2018	1073	0.008	0.950	-	-	0.016	1.450	*0.0065	*1.14	0.008	1.300
12/30/2018	1090	0.000	0.470	-	-	0.011	0.710	0.010	0.570	0.008	0.690
8/27/2019	889	0.002	0.520	-	-	0.021	0.820	0.019	0.870	0.008	0.670
9/3/2019	962	0.004	0.520	-	-	0.020	0.940	0.016	0.900	0.004	0.730
9/5/2019	1031	0.002	0.560	-	-	0.006	0.490	0.011	0.450	0.014	0.800
9/10/2019	1018	0.002	0.560	-	-	0.012	0.470	0.018	0.470	0.012	0.770
9/16/2019	1044	0.006	0.650	-	-	0.020	1.110	0.018	1.080	0.003	0.820
9/24/2019	955	0.006	0.610	-	-	0.011	0.510	0.008	0.580	0.003	0.930
10/1/2019	1127	0.004	0.690	-	-	0.009	0.490	0.009	0.440	0.002	0.930
10/8/2019	940	0.005	0.720	-	-	0.013	1.230	0.022	1.120	0.010	0.980
10/22/2019	947	0.002	0.670	-	-	0.010	0.450	0.012	0.520	0.004	0.880
11/14/2019	617	0.002	0.960	-	-	0.005	1.520	0.008	1.320	0.011	1.140
1/9/2020	1168	0.003	0.760	-	-	0.029	1.110	0.019	1.050	0.001	0.990
1/23/2020	1745	0.003	0.370	-	-	0.006	0.520	0.006	0.510	0.001	0.430
1/29/2020	1717	0.002	0.350	-	-	0.004	0.510	0.006	0.530	0.001	0.460
2/11/2020	1743	0.006	0.830	-	-	0.010	0.660	0.005	0.570	0.001	0.540
2/18/2020	1087	0.003	0.800	-	-	0.011	1.270	0.016	1.110	0.002	1.120
9/17/2020	866	0.001	0.240	0.005	0.360	0.031	1.260	0.004	0.390	0.005	0.380
9/22/2020	973	0.001	0.280	*0.0092	*0.35	0.019	1.150	0.010	0.410	0.001	0.390
9/24/2020	853	0.000	0.270	0.004	0.450	0.025	1.240	0.014	0.440	*0.0152	*0.41
9/30/2020	868	0.000	0.260	0.005	0.430	0.043	1.130	0.017	0.410	0.004	0.380
10/6/2020	821	0.000	0.270	*0.0000	*0.45	0.021	1.280	0.010	0.400	0.004	0.330
10/13/2020	917	0.000	0.270	0.009	0.410	0.026	1.220	0.002	0.390	0.006	0.410
10/20/2020	1037	0.000	0.260	0.004	0.450	0.021	1.240	0.004	0.400	0.003	0.400
12/30/2020	1028	0.001	0.370	0.009	0.500	0.025	1.610	0.007	0.570	0.004	0.520
1/20/2021	1012	0.004	0.380	0.007	0.550	0.031	1.590	0.015	0.590	0.005	0.520

Table 3. (continued)

Release Date	Release (n)	Gate 1		Gate 5		Gate 6		Gate 7		Gate 8	
		TE	$\%Q_{di}$	TE	$\%Q_{di}$	TE	$\%Q_{di}$	TE	$\%Q_{di}$	TE	$\%Q_{di}$
2/10/2021	1012	0.001	0.340	0.004	0.550	0.017	1.590	0.010	0.540	0.006	0.460
2/17/2021	1116	0.000	0.370	0.004	0.510	0.019	0.640	0.017	0.510	0.004	0.440
2/26/2021	1070	0.004	0.390	0.003	0.540	0.032	1.650	0.016	0.510	0.006	0.690
9/30/2021	687	0.002	0.270	0.003	0.370	0.015	1.150	0.004	0.340	0.009	0.360
1/12/2022	1520	0.005	0.330	0.008	0.510	*0.0158	*2.04	0.007	0.470	0.001	0.440
1/20/2022	1497	0.007	0.360	0.006	0.470	0.013	0.750	0.007	0.480	0.004	0.460
1/24/2022	1434	0.004	0.340	0.010	0.480	0.010	0.790	0.006	0.490	0.001	0.450
1/27/2022	1304	*0.0069	*0.32	0.007	0.490	0.016	0.720	0.007	0.440	0.002	0.450
2/3/2022	1597	0.006	0.330	0.007	0.510	0.024	1.600	0.003	0.460	0.004	0.500
2/10/2022	1234	*0.0081	*0.35	0.007	0.500	0.025	1.540	0.005	0.450	0.004	0.500
1/23/2023	875	0.000	0.240	0.000	0.380	0.024	1.100	0.002	0.380	0.000	0.280
2/4/2023	1499	0.000	0.250	*0.0120	*0.44	0.033	1.320	0.005	0.430	0.002	0.400
2/9/2023	853	0.000	0.290	0.001	0.500	0.013	1.450	0.012	0.460	0.004	0.440
10/12/2023	880	0.000	0.280	0.006	0.360	0.017	1.290	0.009	0.320	0.000	0.300
10/18/2023	911	0.000	0.290	0.009	0.400	0.014	1.300	0.007	0.360	0.000	0.290

*Outlier or influential observation excluded; not used in trap efficiency modeling

Table 4. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for winter Chinook Salmon passing RBDD (RK 391) for the period 7/1/2022 through 6/30/2023 (brood year 2022). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents and include genetic corrections. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of the fry to pre-smolt/smolt survival rate (49.47% or ~2.021:1; O'Farrell 2018).

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
27 (Jul)	0.97	0	0	0	-	0
28	0.91	50 (0, 107)	0	50 (0, 107)	35.5	50 (0, 107)
29	0.91	0	0	0	-	0
30	0.91	71 (0, 169)	0	71 (0, 169)	33.7	71 (0, 169)
31 (Aug)	0.91	46 (0, 97)	0	46 (0, 97)	36	46 (0, 97)
32	0.77	400 (171, 627)	0	400 (171, 627)	36.2	400 (171, 627)
33	0.89	413 (237, 596)	0	413 (237, 596)	35.2	413 (237, 596)
34	0.91	1085 (691, 1494)	0	1085 (691, 1494)	34.9	1085 (691, 1494)
35 (Sep)	0.91	2999 (1831, 4262)	0	2999 (1831, 4262)	35.1	2999 (1831, 4262)
36	0.91	3654 (3029, 4265)	0	3654 (3029, 4265)	35.4	3654 (3029, 4265)
37	0.91	2751 (1218, 4445)	22 (0, 67)	2773 (1239, 4474)	36	2795 (1246, 4485)
38	0.89	18715 (8091, 34173)	1766 (104, 4615)	20481 (8197, 38826)	39.8	22285 (8301, 43460)
39	0.91	27040 (23261, 31174)	222 (109, 367)	27261 (23405, 31473)	36.6	27489 (23544, 31796)
40 (Oct)	0.94	18946 (17226, 20763)	316 (200, 451)	19262 (17460, 21134)	36.9	19585 (17712, 21510)
41	0.91	8006 (6945, 9107)	887 (586, 1230)	8892 (7764, 10019)	39.7	9799 (8557, 11063)
42	0.91	9098 (8019, 10176)	1576 (1037, 2161)	10674 (9410, 11946)	41.1	12284 (10646, 13945)
43	0.91	5689 (4462, 6785)	1695 (1336, 2092)	7384 (6070, 8462)	43.4	9116 (7662, 10373)
44 (Nov)	0.91	1729 (1055, 2491)	2503 (2219, 2840)	4233 (3546, 5064)	49.8	6789 (5968, 7782)
45	0.89	521 (292, 791)	2709 (1580, 4008)	3230 (1949, 4751)	57.7	5998 (3547, 8841)
46	0.91	153 (67, 241)	9628 (7207, 12227)	9781 (7351, 12398)	63.6	19617 (14721, 24862)
47	0.57	30 (0, 92)	5503 (4836, 6232)	5533 (4841, 6311)	63.2	11155 (9777, 12677)
48 (Dec)	0.80	0	3531 (2609, 4618)	3531 (2609, 4618)	66.1	7138 (5274, 9336)
49	0.59	0	10381 (2067, 20817)	10381 (2067, 20817)	69	20987 (4179, 42084)
50	0.81	0	8525 (5367, 12234)	8525 (5367, 12234)	71.2	17234 (10850, 24733)
51	0.89	0	1067 (646, 1491)	1067 (646, 1491)	71.4	2157 (1306, 3014)
52	0.45	0	12676 (963, 26731)	12676 (963, 26731)	76.6	25626 (1947, 54040)

Table 4. (continued)

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
1 (Jan)	0.44	0	3429 (2583, 4273)	3429 (2583, 4273)	78.9	6932 (5222, 8638)
2	0.00	0	4696 (2134, 7734)	4696 (2134, 7734)	-	9494 (4314, 15635)
3	0.43	0	5964 (784, 12152)	5964 (784, 12152)	88.1	12057 (1585, 24567)
4	0.86	0	1269 (493, 2637)	1269 (493, 2637)	91	2565 (997, 5331)
5 (Feb)	0.83	0	529 (93, 1123)	529 (93, 1123)	105	1069 (188, 2270)
6	1.00	0	581 (23, 1388)	581 (23, 1388)	104.2	1175 (46, 2806)
7	1.00	0	25 (0, 76)	25 (0, 76)	114	51 (0, 154)
8	1.00	0	50 (0, 153)	50 (0, 153)	123	101 (0, 309)
9 (Mar)	0.81	0	747 (29, 2035)	747 (29, 2035)	116	1510 (59, 4114)
10	0.57	0	120 (0, 358)	120 (0, 358)	104	243 (0, 724)
11	0.11	0	1054 (869, 1273)	1054 (869, 1273)	160	2131 (1757, 2574)
12	0.77	0	511 (163, 870)	511 (163, 870)	125	1033 (330, 1759)
13	0.66	0	440 (0, 929)	440 (0, 929)	116.4	890 (0, 1878)
14 (Apr)	0.86	0	394 (24, 840)	394 (24, 840)	136.7	797 (49, 1698)
15	0.97	0	476 (243, 721)	476 (243, 721)	135.9	962 (491, 1458)
16	1.00	0	59 (0, 128)	59 (0, 128)	135.5	119 (0, 259)
17	0.43	0	0	0	-	0
18 (May)	0.79	0	0	0	-	0
19	0.79	0	0	0	-	0
20	1.00	0	0	0	-	0
21	0.87	0	0	0	-	0
22 (Jun)	0.84	0	0	0	-	0
23	0.90	0	0	0	-	0
24	1.00	0	0	0	-	0
25	0.94	0	0	0	-	0
26	1.00	0	0	0	-	0
BY 2022 total		101,396	83,351	184,746		269,901
95% CI		(88853, 117545)	(64765, 103062)	(160140, 211303)		(227870, 314461)

Table 5. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for winter Chinook Salmon passing RBDD (RK 391) for the period 7/1/2023 through 6/30/2024 (brood year 2023). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents and include genetic corrections. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of the fry to pre-smolt/smolt survival rate (50.66% or ~1.974:1; O'Farrell 2018).

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
27 (Jul)	1.00	0	0	0	-	0
28	0.97	0	0	0	-	0
29	1.00	0	0	0	-	0
30	1.00	0	0	0	-	0
31 (Aug)	1.00	190 (59, 368)	0	190 (59, 368)	37.5	190 (59, 368)
32	1.00	569 (304, 839)	0	569 (304, 839)	37.8	569 (304, 839)
33	1.00	1557 (1061, 2123)	0	1557 (1061, 2123)	35.4	1557 (1061, 2123)
34	1.00	3839 (2818, 4956)	33 (0, 103)	3872 (2825, 5054)	35.2	3904 (2831, 5147)
35 (Sep)	1.00	5669 (4386, 7311)	0	5669 (4386, 7311)	35	5669 (4386, 7311)
36	1.00	25483 (19752, 31512)	30 (0, 93)	25513 (19780, 31545)	35.4	25542 (19818, 31556)
37	1.00	35158 (25191, 46916)	0	35158 (25191, 46916)	35.3	35158 (25191, 46916)
38	1.00	78273 (60147, 99580)	400 (153, 668)	78673 (60302, 100201)	36.5	79063 (60463, 100806)
39	1.00	55318 (46471, 65095)	659 (476, 882)	55977 (47114, 65769)	37.4	56619 (47695, 66376)
40 (Oct)	1.00	86372 (73163, 98171)	13706 (5719, 22889)	100078 (83147, 116371)	40.7	113428 (90531, 136866)
41	1.00	81076 (72014, 91489)	16721 (8801, 26206)	97797 (85900, 110979)	42.4	114083 (96305, 134660)
42	0.97	73808 (64204, 84184)	18263 (12759, 23839)	92072 (83605, 101440)	44.4	109859 (100147, 121474)
43	1.00	48193 (38291, 59227)	12688 (8290, 17474)	60881 (50498, 72357)	46.3	73239 (60951, 87206)
44 (Nov)	0.97	30384 (24745, 36024)	12524 (8161, 17364)	42908 (34306, 50960)	47.2	55106 (43047, 67239)
45	0.89	19443 (16438, 22627)	15695 (9125, 22648)	35137 (28753, 41909)	49.8	50425 (37842, 63432)
46	0.89	6711 (4980, 8670)	29128 (22577, 36039)	35839 (28686, 43329)	54.4	64210 (50667, 78387)
47	0.80	20572 (1918, 48762)	53439 (22072, 102839)	74010 (24241, 150857)	57.8	126060 (45903, 250716)
48 (Dec)	0.80	2932 (1801, 4433)	28900 (19825, 38742)	31832 (22584, 41604)	58	59980 (42030, 79226)
49	0.86	0	11589 (8944, 14798)	11589 (8944, 14798)	63.1	22877 (17655, 29211)
50	0.86	0	9537 (7807, 11166)	9537 (7807, 11166)	64.9	18826 (15411, 22042)
51	0.89	0	61720 (23588, 108029)	61720 (23588, 108029)	68.3	121835 (46562, 213248)
52	0.49	0	2561 (322, 6266)	2561 (322, 6266)	71.6	5055 (636, 12369)

Table 5. (continued)

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
1 (Jan)	0.86	0	5623 (2155, 11508)	5623 (2155, 11508)	73.5	11100 (4254, 22717)
2	0.74	0	656 (313, 1084)	656 (313, 1084)	81.5	1295 (618, 2140)
3	0.71	0	3287 (1037, 6033)	3287 (1037, 6033)	75.5	6489 (2047, 11909)
4	0.51	0	5436 (3858, 6888)	5436 (3858, 6888)	84.9	10731 (7616, 13597)
5 (Feb)	0.29	0	1437 (1006, 1914)	1437 (1006, 1914)	94.6	2837 (1986, 3778)
6	0.46	0	2971 (571, 6149)	2971 (571, 6149)	79.7	5865 (1127, 12139)
7	0.66	0	1977 (814, 3772)	1977 (814, 3772)	100.6	3903 (1607, 7446)
8	0.00	0	1620 (708, 2704)	1620 (708, 2704)	-	3198 (1398, 5338)
9 (Mar)	0.34	0	1263 (0, 2607)	1263 (0, 2607)	119	2493 (0, 5146)
10	0.69	0	4091 (2242, 6309)	4091 (2242, 6309)	110.7	8076 (4426, 12454)
11	0.74	0	1978 (1377, 2652)	1978 (1377, 2652)	109.6	3905 (2718, 5235)
12	0.54	0	1023 (585, 1596)	1023 (585, 1596)	114.1	2019 (1155, 3150)
13	0.29	0	1433 (963, 1899)	1433 (963, 1899)	112.8	2829 (1901, 3749)
14 (Apr)	1.00	0	104 (31, 194)	104 (31, 194)	116	205 (61, 383)
15	0.71	0	155 (48, 264)	155 (48, 264)	112.7	306 (95, 521)
16	0.71	0	106 (0, 323)	106 (0, 323)	121	209 (0, 638)
17	0.97	0	0	0	-	0
18 (May)	0.97	0	0	0	-	0
19	1.00	0	0	0	-	0
20	1.00	0	0	0	-	0
21	0.97	0	0	0	-	0
22 (Jun)	0.83	0	0	0	-	0
23	0.80	0	0	0	-	0
24	0.80	0	0	0	-	0
25	0.80	0	0	0	-	0
26	0.69	0	0	0	-	0
BY 2023 total		575,547	320,753	896,299		1,208,714
95% CI		(534201, 618090)	(261544, 388396)	(813140, 989901)		(1071748, 1364795)

Table 6. Winter Chinook Salmon fry-equivalent juvenile production indices (JPI), lower and upper 90% confidence intervals (CI), estimated adult female spawners above RBDD (Estimated Females), estimates of female fecundity, calculated juveniles per estimated female (Estimated Recruits/Female) and egg-to-fry survival estimates (ETF) with associated lower and upper 90% confidence intervals (LCI , UCI) by brood year (BY) for Chinook Salmon sampled at RBDD rotary screw-traps between July 2013 and June 2024. NOTE: BY2020 through BY2023 estimated using the GLMs with 95% confidence intervals.

BY	Fry Equivalent JPI	Lower 90% CI	Upper 90% CI	Estimated Females[1]	Fecundity[2]	Estimated Recruits/Female	ETF Survival (%)	ETF Survival LCI, UCI
2013	2,481,324	1,539,193	3,423,456	3,577	4,596	694	15.09	(9.4, 20.8)
2014	523,872	301,197	746,546	1,681	5,308	312	5.87	(3.4, 8.4)
2015	440,951	288,911	592,992	2,022	4,819	218	4.53	(3.0, 6.1)
2016	640,149	429,876	850,422	653	4,131	980	23.73	(15.9, 31.5)
2017	734,432	471,292	997,572	367	4,109	2,001	48.70	(31.3, 66.2)
2018	1,477,529	824,706	2,130,352	1,080	5,141	1,368	26.61	(14.9, 38.4)
2019	4,691,764	2,630,095	6,753,433	4,884	5,424	961	17.71	(9.9, 25.5)
BY	**Fry Equivalent JPI (GLM)**	**Lower 95% CI**	**Upper 95% CI**					
2020	1,786,374	1,659,334	1,928,575	3,904	4,991	458	9.17	(8.5, 9.9)
2021	578,293	530,416	627,947	5,860	5,312	99	1.86	(1.7, 2.0)
2022	269,901	227,870	314,461	2,607	5,505	104	1.88	(1.6, 2.2)
2023	1,208,714	1,071,748	1,364,795	1,061	5,510	1,139	20.68	(18.3, 23.4)
					10-Year Mean	758	15.98	(10.7, 21.3)
					Standard Deviation	600	13.96	(9.0, 19.2)

[1]Estimated females derived from carcass survey data; includes annual estimates of pre-spawn mortality.

[2]Female fecundity estimates typically based on annual average values from LSNFH winter Chinook Salmon spawning data. The exception being 2016 and 2017 values based on total egg deposition by size class (See Voss and Poytress 2019).

Table 7. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for spring Chinook Salmon passing RBDD (RK 391) for the period 10/16/2022 through 10/15/2023 (brood year 2022). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents with mark and genetic corrections. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of a fry to pre-smolt/smolt survival rate (59% or 1.7:1; Hallock undated).

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage	Total Passage	Mean FL (mm)	Fry-equivalent JPI
42	0.91	0	0	0	-	0
43	0.91	0	0	0	-	0
44 (Nov)	0.91	0	0	0	-	0
45	0.89	0	0	0	-	0
46	0.91	663	0	663	36.4	663
47	0.57	3141	0	3141	35	3141
48 (Dec)	0.80	11469	0	11469	35.4	11469
49	0.59	6137	0	6137	36.4	6137
50	0.81	11284	90	11374	38.3	11437
51	0.89	1237	64	1301	39.8	1345
52	0.45	2942	2802	5745	44	7691
1 (Jan)	0.44	1246	761	2007	46.7	2536
2	0.00	623	4785	5408	-	8734
3	0.43	0	8809	8809	53.5	14931
4	0.86	0	2372	2372	54.8	4020
5 (Feb)	0.83	0	208	208	60.5	353
6	1.00	0	357	357	59.4	605
7	1.00	0	72	72	63	122
8	1.00	0	48	48	61	81
9 (Mar)	0.81	0	881	881	72.6	1493
10	0.57	0	141	141	68.7	239
11	0.11	0	2107	2107	81	3571
12	0.77	0	0	0	72.1	0
13	0.66	0	0	0	76.7	0
14 (Apr)	0.86	0	0	0	78.7	0
15	0.97	0	0	0	86.7	0

Table 7. (continued)

Week	Trap Effort	Fry Passage	Pre-smolt/smolt Passage	Total Passage	Mean FL (mm)	Fry-equivalent JPI
16	1.00	0	945	945	89.5	1602
17	0.43	0	0	0	90	0
18 (May)	0.79	0	1609	1609	95.2	2727
19	0.79	0	746	746	99.9	1264
20	1.00	0	288	288	104.3	488
21	0.87	0	0	0	109.1	0
22 (Jun)	0.84	0	495	495	114.9	839
23	0.90	0	200	200	127	339
24	1.00	0	6	6	127.3	10
25	0.94	0	0	0	-	0
26	1.00	0	32	32	136	54
27 (Jul)	1.00	0	70	70	144	119
28	0.97	0	0	0	-	0
29	1.00	0	0	0	-	0
30	1.00	0	0	0	-	0
31 (Aug)	1.00	0	0	0	-	0
32	1.00	0	0	0	-	0
33	1.00	0	0	0	-	0
34	1.00	0	0	0	-	0
35 (Sep)	1.00	0	0	0	-	0
36	1.00	0	0	0	-	0
37	1.00	0	0	0	-	0
38	1.00	0	0	0	-	0
39	1.00	0	0	0	-	0
40 (Oct)	1.00	0	0	0	-	0
41	1.00	0	0	0	-	0
BY 2022 total		38,742	27,888	66,631		86,010
95% CI		(30367, 48134)	(10661, 51030)	(31743, 108468)		(42764, 137109)

Table 8. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for spring Chinook Salmon passing RBDD (RK 391) for the period 10/16/2023 through 10/15/2024 (brood year 2023). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents with mark and genetic corrections. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of the fry to pre-smolt/smolt survival rate (59% or 1.7:1; Hallock undated).

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage	Total Passage	Mean FL (mm)	Fry-equivalent JPI
42	0.97	0	0	0	-	0
43	1.00	0	0	0	-	0
44 (Nov)	0.97	0	0	0	-	0
45	0.89	0	0	0	-	0
46	0.89	0	0	0	-	0
47	0.80	0	0	0	-	0
48 (Dec)	0.80	0	0	0	-	0
49	0.86	3544	95	3639	37.8	3705
50	0.86	905	251	1156	41.2	1330
51	0.89	5152	1991	7143	43.3	8527
52	0.49	520	215	736	44.1	884
1 (Jan)	0.86	893	338	1230	46.7	1466
2	0.74	0	375	375	54.2	636
3	0.71	0	969	969	50.8	1642
4	0.51	0	2110	2110	55.1	3576
5 (Feb)	0.29	0	483	483	55.8	819
6	0.46	0	1960	1960	59.4	3322
7	0.66	0	1205	1205	60.1	2042
8	0.00	0	1210	1210	-	2052
9 (Mar)	0.34	0	1216	1216	73.5	2061
10	0.69	0	13552	13552	71.6	22969
11	0.74	0	0	0	73.6	0
12	0.54	0	11392	11392	76.2	19308
13	0.29	0	10127	10127	78.2	17164
14 (Apr)	1.00	0	0	0	81.7	0
15	0.71	0	8479	8479	85.7	14371

Table 8. (continued)

Week	Trap Effort	Fry Passage	Pre-smolt/smolt Passage	Total Passage	Mean FL (mm)	Fry-equivalent JPI
16	0.71	0	17240	17240	89.9	29220
17	0.97	0	18466	18466	93.6	31298
18 (May)	0.97	0	14488	14488	97.2	24556
19	1.00	0	6696	6696	100.6	11349
20	1.00	0	1293	1293	103.8	2192
21	0.97	0	1653	1653	108.3	2802
22 (Jun)	0.83	0	128	128	111.7	217
23	0.80	0	78	78	130	132
24	0.80	0	29	29	125	49
25	0.80	0	30	30	124	51
26	0.69	0	45	45	146	76
27 (Jul)	0.97	0	37	37	136	63
28	1.00	0	0	0	-	0
29	1.00	0	0	0	-	0
30	0.86	0	0	0	-	0
31 (Aug)	1.00	0	0	0	-	0
32	0.97	0	0	0	-	0
33	0.83	0	0	0	-	0
34	1.00	0	0	0	-	0
35 (Sep)	1.00	0	0	0	-	0
36	1.00	0	0	0	-	0
37	0.95	0	0	0	-	0
38	0.90	0	0	0	-	0
39	0.93	0	0	0	-	0
40 (Oct)	0.95	0	0	0	-	0
41	0.95	0	0	0	-	0
BY 2023 total		11,014	116,151	127,165		207,879
95% CI		(6015, 18958)	(55309, 186771)	(65427, 197949)		(104368, 327274)

Table 9. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for fall Chinook Salmon passing RBDD (RK 391) for the period 12/1/2022 through 11/30/2023 (brood year 2022). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents with mark corrections. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of the fry to pre-smolt/smolt survival rate (59% or 1.7:1; Hallock undated).

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage	Total Passage	Mean FL (mm)	Fry-equivalent JPI
48 (Dec)	0.80	0	0	0	-	0
49	0.59	3715	0	3715	33.9	3715
50	0.81	16413	0	16413	34.4	16413
51	0.89	11417	0	11417	35.4	11417
52	0.45	725899	0	725899	36.1	725899
1 (Jan)	0.44	60178	0	60178	36	60178
2	0.00	360032	318	360350	-	360571
3	0.43	659885	637	660522	36.8	660965
4	0.86	132306	366	132672	37.7	132926
5 (Feb)	0.83	624240	56	624296	36.7	624335
6	1.00	152615	324	152939	37.7	153164
7	1.00	37522	116	37638	37.7	37719
8	1.00	20745	173	20918	37.9	21038
9 (Mar)	0.81	12965	0	12965	38.2	12965
10	0.57	2812	487	3299	43.1	3637
11	0.11	14041	17535	31576	50.2	43761
12	0.77	10169	13803	23972	53	33564
13	0.66	1154	57410	58564	62.6	98459
14 (Apr)	0.86	6102	31585	37687	64.2	59636
15	0.97	789	3120	3909	67.2	6077
16	1.00	0	5294	5294	76.5	8973
17	0.43	0	26088	26088	77	44217
18 (May)	0.79	0	75229	75229	75.4	127507
19	0.79	0	36015	36015	79	61042
20	1.00	0	37450	37450	83.2	63475
21	0.87	0	43842	43842	85.9	74308

Table 9. (continued)

Week	Trap Effort	Fry Passage	Pre-smolt/smolt Passage	Total Passage	Mean FL (mm)	Fry-equivalent JPI
22 (Jun)	0.84	0	48346	48346	85.6	81942
23	0.90	0	45629	45629	84.4	77337
24	1.00	0	48368	48368	84.8	81980
25	0.94	0	33118	33118	84.3	56132
26	1.00	0	27965	27965	86.4	47398
27 (Jul)	1.00	0	55326	55326	86	93773
28	0.97	0	38331	38331	85.4	64968
29	1.00	0	30585	30585	87.7	51839
30	1.00	0	23095	23095	88.9	39144
31 (Aug)	1.00	0	26774	26774	92	45380
32	1.00	0	16551	16551	93.3	28053
33	1.00	0	5768	5768	98	9776
34	1.00	0	3946	3946	101.5	6688
35 (Sep)	1.00	0	2737	2737	103.8	4639
36	1.00	0	3544	3544	106	6007
37	1.00	0	624	624	107.2	1058
38	1.00	0	623	623	113.5	1056
39	1.00	0	316	316	113.2	536
40 (Oct)	1.00	0	309	309	117.1	524
41	1.00	0	206	206	126.8	349
42	0.97	0	307	307	131.6	520
43	1.00	0	288	288	144.4	488
44 (Nov)	0.97	0	0	0	-	0
45	0.89	0	79	79	149.7	134
46	0.89	0	61	61	157.5	103
47	0.80	0	0	0	-	0
BY 2022 total		2,852,999	762,744	3,615,743		4,145,785
95% CI		(1493348, 4358493)	(495274, 1052074)	(1640597, 6097387)		(2174959, 6577717)

Table 10. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for fall Chinook Salmon passing RBDD (RK 391) for the period 12/1/2023 through 11/30/2024 (brood year 2023). Trap sampling effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents with mark corrections. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of the fry to pre-smolt/smolt survival rate (59% or 1.7:1; Hallock undated).

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage	Total Passage	Mean FL (mm)	Fry-equivalent JPI
48 (Dec)	0.80	31	0	31	33	31
49	0.86	901	0	901	34	901
50	0.86	2659	0	2659	34.5	2659
51	0.89	32799	0	32799	35.3	32799
52	0.49	25452	0	25452	36	25452
1 (Jan)	0.86	159311	0	159311	36.1	159311
2	0.74	98544	0	98544	36.5	98544
3	0.71	272462	0	272462	37.2	272462
4	0.51	275858	7344	283202	37.7	288305
5 (Feb)	0.29	73202	129	73331	37.4	73421
6	0.46	24041	1838	25879	38.1	27156
7	0.66	57536	1527	59063	38.1	60124
8	0.00	31740	2278	34018	-	35601
9 (Mar)	0.34	5943	3029	8972	42.5	11077
10	0.69	17615	26512	44127	48.2	62551
11	0.74	15889	15698	31587	48.8	42496
12	0.54	8241	23925	32166	53.1	48792
13	0.29	2716	79747	82463	61.7	137880
14 (Apr)	1.00	670	11650	12320	65.4	20416
15	0.71	255	11457	11712	70.8	19674
16	0.71	0	32712	32712	73.5	55444
17	0.97	40	53929	53969	77.7	91445
18 (May)	0.97	0	93166	93166	79.4	157908
19	1.00	0	119135	119135	80.3	201924
20	1.00	0	43911	43911	81.8	74425
21	0.97	0	103044	103044	82.6	174651

Table 10. (continued)

Week	Trap Effort	Fry Passage	Pre-smolt/smolt Passage	Total Passage	Mean FL (mm)	Fry-equivalent JPI
22 (Jun)	0.83	0	39424	39424	81.5	66820
23	0.80	0	11017	11017	81.3	18673
24	0.80	0	14621	14621	85	24781
25	0.80	0	14095	14095	86.4	23890
26	0.69	0	18390	18390	86.8	31169
27 (Jul)	0.97	0	7625	7625	87.5	12924
28	1.00	0	4980	4980	90.8	8441
29	1.00	0	3872	3872	94.3	6563
30	0.86	0	3136	3136	96.3	5315
31 (Aug)	1.00	0	1861	1861	96	3154
32	0.97	0	1436	1436	99.2	2434
33	0.83	0	710	710	101.1	1203
34	1.00	0	887	887	110.5	1503
35 (Sep)	1.00	0	574	574	107.7	973
36	1.00	0	71	71	107	120
37	0.95	0	275	275	121	466
38	0.90	0	538	538	124.6	912
39	0.93	0	1065	1065	123.6	1805
40 (Oct)	0.95	0	633	633	127	1073
41	0.95	0	979	979	130.2	1659
42	0.93	0	882	882	134.7	1495
43	0.95	0	771	771	136.1	1307
44 (Nov)	0.92	0	794	794	142.9	1346
45	0.97	0	210	210	153.1	356
46	1.00	0	27	27	152	46
47	0.43	0	67	67	156	114
BY 2023 total		1,105,905	759,971	1,865,876		2,393,991
95% CI		(837318, 1393512)	(405848, 1178134)	(1097614, 2787142)		(1496008, 3424235)

Table 11. Fall Chinook Salmon fry-equivalent juvenile production indices (JPI), lower and upper confidence intervals (CI), estimated adult female spawners above RBDD (Estimated Females), estimates of female fecundity, calculated juveniles per estimated female (Estimated Recruits/Female) and egg-to-fry survival estimates (ETF) with associated lower and upper 90% confidence intervals (LCI , UCI) by brood year (BY) for Chinook Salmon sampled at RBDD rotary screw-traps between December 2013 and November 2024. Brood years 2013 through 2023 include estimates with mark corrections to reduce bias to JPI estimates. NOTE: BY2020 through 2023 estimated using the GLMs with 95% confidence intervals.

BY	Fry Equivalent JPI	Lower 90% CI	Upper 90% CI	Estimated Females[1]	Fecundity	Estimated Recruits/Female	ETF Survival (%)	LCI, UCI
2013	33,201,448	5,766,067	60,636,829	39,422	5,390	842	15.63	(2.7, 28.5)
2014	4,387,348	2,407,113	6,367,583	35,345	5,453	124	2.28	(1.2, 3.3)
2015	19,406,341	214,690	38,597,991	23,302	4,971	833	16.75	(0.2, 33.3)
2016	9,886,303	0	22,438,916	5,240	4,778	1,887	39.49	(0.0, 89.6)
2017	1,723,831	980,638	2,467,025	4,437	4,455	389	8.72	(5.0, 12.5)
2018	6,837,157	1,108,574	12,565,741	11,631	5,442	588	10.80	(1.8, 19.9)
2019[2]	7,575,182	2,718,701	12,431,662	24,421	4,815	310	6.44	(2.3, 10.6)
BY	**Fry Equivalent JPI (GLM)**	**Lower 95% CI**	**Upper 95% CI**					
2020	5,654,675	2,883,689	9,045,417	20,802	5,166	272	5.26	(2.7, 8.4)
2021[3]	4,253,180	2,304,724	6,565,210	22,987	5,029	185	3.68	(2.0, 5.7)
2022[4]	4,145,785	2,174,959	6,577,717	5,541	4,884	748	15.32	(8.0, 24.3)
2023	2,393,991	1,496,008	3,424,235	2,892	5,629	828	14.71	(9.2, 21.0)
					Mean	637	12.64	(3.2, 23.4)
					Standard Deviation	496	10.28	(3.0, 24.0)

[1] Sex ratios used to determine female spawners based on CNFH data between 2008 and 2023.

[2] BY2019 has incomplete data collection due to COVID-19 and is excluded from Average and Standard Deviation calculations.

[3] No attempt was made to remove 1,859,029 BY2021 *unmarked* CNFH unfed fall Chinook Salmon fry released upstream of RBDD in this year.

[4] No attempt was made to remove 2,766,360 BY2022 *unmarked* CNFH unfed fall Chinook Salmon fry released upstream of RBDD in this year.

Table 12. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for late-fall Chinook Salmon passing RBDD (RK 391) for the period 4/1/2022 through 3/30/2023 (brood year 2022). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of the fry to pre-smolt/smolt survival rate (59% or 1.7:1; Hallock undated).

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
14 (Apr)	0.49	0	0	0	-	0
15	0.80	30 (0, 93)	0	30 (0, 93)	29	30 (0, 93)
16	0.61	114 (0, 273)	0	114 (0, 273)	34.7	114 (0, 273)
17	1.00	294 (64, 595)	0	294 (64, 595)	36.4	294 (64, 595)
18 (May)	1.00	0	0	0	-	0
19	1.00	21 (0, 64)	0	21 (0, 64)	37	21 (0, 64)
20	1.00	48 (0, 115)	0	48 (0, 115)	40	48 (0, 115)
21	1.00	44 (0, 93)	0	44 (0, 93)	41.5	44 (0, 93)
22 (Jun)	0.66	0	0	0	-	0
23	0.80	0	117 (0, 268)	117 (0, 268)	48.8	198 (0, 454)
24	0.80	0	92 (22, 186)	92 (22, 186)	53.5	156 (37, 315)
25	0.80	70 (0, 170)	259 (47, 524)	329 (47, 688)	50.5	509 (80, 1052)
26	0.80	49 (0, 103)	23 (0, 70)	72 (23, 126)	43.3	88 (23, 164)
27 (Jul)	0.97	0	101 (24, 196)	101 (24, 196)	54.8	171 (41, 332)
28	0.91	0	23 (0, 70)	23 (0, 70)	57	39 (0, 119)
29	0.91	0	0	0	-	0
30	0.91	0	23 (0, 70)	23 (0, 70)	49	39 (0, 119)
31 (Aug)	0.91	0	0	0	-	0
32	0.77	0	28 (0, 86)	28 (0, 86)	78	47 (0, 146)
33	0.89	0	0	0	-	0
34	0.91	0	0	0	-	0
35 (Sep)	0.91	0	0	0	-	0
36	0.91	0	22 (0, 67)	22 (0, 67)	94	37 (0, 114)
37	0.91	0	22 (0, 68)	22 (0, 68)	94	37 (0, 115)
38	0.89	0	1145 (41, 2897)	1145 (41, 2897)	76.6	1941 (69, 4910)
39	0.91	0	110 (21, 235)	110 (21, 235)	75.4	186 (36, 398)

Table 12. (continued)

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
40 (Oct)	0.94	0	108 (41, 191)	108 (41, 191)	76.4	183 (69, 324)
41	0.91	0	149 (41, 276)	149 (41, 276)	77.7	253 (69, 468)
42	0.91	0	174 (66, 294)	174 (66, 294)	79	295 (112, 498)
43	0.91	0	182 (70, 301)	182 (70, 301)	77	308 (119, 510)
44 (Nov)	0.91	0	228 (111, 353)	228 (111, 353)	88.4	386 (188, 598)
45	0.89	0	343 (121, 574)	343 (121, 574)	93.8	581 (205, 973)
46	0.91	0	615 (459, 779)	615 (459, 779)	95.8	1042 (778, 1320)
47	0.57	0	380 (123, 685)	380 (123, 685)	106	644 (208, 1161)
48 (Dec)	0.80	0	186 (49, 349)	186 (49, 349)	109.3	315 (83, 592)
49	0.59	0	392 (57, 841)	392 (57, 841)	104.2	664 (97, 1425)
50	0.81	0	1394 (919, 1962)	1394 (919, 1962)	127.8	2363 (1558, 3325)
51	0.89	0	216 (116, 326)	216 (116, 326)	116.2	366 (197, 553)
52	0.45	0	1179 (0, 2386)	1179 (0, 2386)	121.5	1998 (0, 4044)
1 (Jan)	0.44	0	568 (0, 1099)	568 (0, 1099)	121	963 (0, 1863)
2	0.00	0	284 (0, 550)	284 (0, 550)	-	482 (0, 932)
3	0.43	0	0	0	-	0
4	0.86	0	235 (34, 565)	235 (34, 565)	136.6	398 (58, 958)
5 (Feb)	0.83	0	0	0	-	0
6	1.00	0	0	0	-	0
7	1.00	0	24 (0, 74)	24 (0, 74)	147	41 (0, 125)
8	1.00	0	0	0	-	0
9 (Mar)	0.81	0	0	0	-	0
10	0.57	0	0	0	-	0
11	0.11	0	0	0	-	0
12	0.77	0	0	0	-	0
13	0.66	0	0	0	-	0
BY 2022 total		670	8,622	9,292		15,281
95% CI		(352, 1032)	(6474, 10953)	(7083, 11672)		(11576, 19276)

Table 13. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for late-fall Chinook Salmon passing RBDD (RK 391) for the period 4/1/2023 through 3/30/2024 (brood year 2023). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of the fry to pre-smolt/smolt survival rate (59% or 1.7:1; Hallock undated).

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
14 (Apr)	0.86	0	0	0	-	0
15	0.97	430 (166, 727)	0	430 (166, 727)	34.5	430 (166, 727)
16	1.00	154 (58, 269)	0	154 (58, 269)	33.4	154 (58, 269)
17	0.43	520 (0, 1102)	0	520 (0, 1102)	32.5	520 (0, 1102)
18 (May)	0.79	212 (0, 467)	0	212 (0, 467)	36	212 (0, 467)
19	0.79	110 (0, 345)	0	110 (0, 345)	35.5	110 (0, 345)
20	1.00	174 (62, 295)	0	174 (62, 295)	39	174 (62, 295)
21	0.87	179 (39, 354)	0	179 (39, 354)	37.8	179 (39, 354)
22 (Jun)	0.84	88 (0, 199)	0	88 (0, 199)	41	88 (0, 199)
23	0.90	32 (0, 99)	0	32 (0, 99)	42	32 (0, 99)
24	1.00	0	33 (0, 101)	33 (0, 101)	53	56 (0, 171)
25	0.94	0	70 (0, 218)	70 (0, 218)	55	119 (0, 369)
26	1.00	0	32 (0, 98)	32 (0, 98)	54	54 (0, 166)
27 (Jul)	1.00	0	395 (176, 651)	395 (176, 651)	60.9	669 (298, 1103)
28	0.97	0	863 (411, 1457)	863 (411, 1457)	62	1463 (697, 2469)
29	1.00	31 (0, 98)	1010 (679, 1387)	1041 (714, 1411)	63.6	1743 (1190, 2378)
30	1.00	0	2098 (1282, 3020)	2098 (1282, 3020)	67.1	3556 (2173, 5119)
31 (Aug)	1.00	0	1790 (1190, 2521)	1790 (1190, 2521)	69.3	3034 (2017, 4273)
32	1.00	0	1408 (1046, 1848)	1408 (1046, 1848)	72.7	2386 (1773, 3132)
33	1.00	0	1008 (749, 1270)	1008 (749, 1270)	75.8	1708 (1269, 2153)
34	1.00	0	812 (592, 1062)	812 (592, 1062)	78.1	1376 (1003, 1800)
35 (Sep)	1.00	0	673 (490, 844)	673 (490, 844)	83.6	1141 (831, 1431)
36	1.00	0	852 (529, 1284)	852 (529, 1284)	86.4	1444 (897, 2176)
37	1.00	0	410 (256, 594)	410 (256, 594)	90.2	695 (434, 1007)
38	1.00	0	359 (256, 467)	359 (256, 467)	95.3	608 (434, 792)
39	1.00	0	508 (213, 813)	508 (213, 813)	92.8	861 (361, 1378)

Table 13. (continued)

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
40 (Oct)	1.00	0	884 (645, 1138)	884 (645, 1138)	86.5	1498 (1093, 1929)
41	1.00	0	1039 (921, 1159)	1039 (921, 1159)	80.6	1761 (1561, 1964)
42	0.97	0	1065 (568, 1533)	1065 (568, 1533)	102.2	1805 (963, 2598)
43	1.00	0	1499 (914, 2170)	1499 (914, 2170)	101	2541 (1549, 3678)
44 (Nov)	0.97	0	1752 (1250, 2282)	1752 (1250, 2282)	109.5	2969 (2119, 3868)
45	0.89	0	1180 (763, 1681)	1180 (763, 1681)	108.7	2000 (1293, 2849)
46	0.89	0	1074 (603, 1541)	1074 (603, 1541)	101.9	1820 (1022, 2612)
47	0.80	0	7093 (679, 19509)	7093 (679, 19509)	111	12022 (1151, 33066)
48 (Dec)	0.80	0	996 (542, 1527)	996 (542, 1527)	112.4	1688 (919, 2588)
49	0.86	0	770 (294, 1344)	770 (294, 1344)	112.2	1305 (498, 2278)
50	0.86	0	812 (547, 1144)	812 (547, 1144)	114.3	1376 (927, 1939)
51	0.89	0	6916 (707, 14768)	6916 (707, 14768)	122.6	11722 (1198, 25030)
52	0.49	0	420 (0, 1126)	420 (0, 1126)	137.8	712 (0, 1908)
1 (Jan)	0.86	0	838 (62, 2122)	838 (62, 2122)	121.2	1420 (105, 3597)
2	0.74	0	72 (0, 155)	72 (0, 155)	135	122 (0, 263)
3	0.71	0	382 (0, 1038)	382 (0, 1038)	130.5	647 (0, 1759)
4	0.51	0	97 (0, 282)	97 (0, 282)	135	164 (0, 478)
5 (Feb)	0.29	0	0	0	-	0
6	0.46	0	0	0	-	0
7	0.66	0	0	0	-	0
8	0.00	0	0	0	-	0
9 (Mar)	0.34	0	0	0	-	0
10	0.69	0	0	0	-	0
11	0.74	0	0	0	-	0
12	0.54	0	0	0	-	0
13	0.29	0	0	0	-	0
BY 2023 total		1,930	39,210	41,140		68,384
95% CI		(1223, 2680)	(27635, 53570)	(29418, 55463)		(48653, 92730)

Table 14. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI) and mean fork length (Med FL) for *O. mykiss* passing Red Bluff Diversion Dam (RK 391) for the period 1/1/2022 through 12/31/2022 (brood year 2022). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include total estimated passage (fry, sub-yearling and yearlings combined).

Week	Trap Effort	Total Passage (95% CI)	Mean FL (mm)	Week (cont.)	Trap Effort (cont.)	Total Passage (95% CI) (cont.)	Mean FL (mm) (cont.)
1 (Jan)	0.84	0	-	27 (Jul)	0.97	197 (92, 307)	88.9
2	0.93	17 (0, 53)	184	28	0.91	93 (0, 238)	96
3	0.91	23 (0, 71)	76	29	0.91	118 (23, 251)	66
4	0.90	0	-	30	0.91	69 (0, 166)	137
5 (Feb)	0.91	34 (0, 105)	76	31 (Aug)	0.91	155 (23, 363)	76.4
6	1.00	0	-	32	0.77	232 (104, 359)	62.6
7	0.97	0	-	33	0.89	145 (47, 253)	62.2
8	1.00	22 (0, 68)	100	34	0.91	90 (0, 232)	49
9 (Mar)	0.99	0	-	35 (Sep)	0.91	118 (44, 204)	79.2
10	0.90	20 (0, 62)	29	36	0.91	114 (24, 244)	90
11	0.70	72 (0, 218)	22.5	37	0.91	153 (68, 240)	69.4
12	0.47	731 (283, 1403)	24.3	38	0.89	380 (175, 611)	75.6
13	0.96	615 (431, 786)	43.8	39	0.91	262 (48, 545)	66.2
14 (Apr)	0.49	526 (168, 782)	51.3	40 (Oct)	0.94	300 (147, 455)	81.4
15	0.80	525 (259, 816)	47.4	41	0.91	194 (83, 317)	83.9
16	0.61	4040 (2318, 5906)	56.4	42	0.91	132 (42, 229)	81.3
17	1.00	3114 (2477, 3727)	55.1	43	0.91	184 (48, 288)	105
18 (May)	1.00	1749 (1353, 2179)	57.2	44 (Nov)	0.91	91 (22, 183)	89.2
19	1.00	1064 (891, 1252)	63.8	45	0.89	43 (0, 92)	76
20	1.00	1981 (1513, 2473)	60.8	46	0.91	153 (90, 213)	84
21	1.00	1036 (750, 1361)	62.5	47	0.57	128 (0, 318)	92.8
22 (Jun)	0.66	808 (448, 1188)	62.6	48 (Dec)	0.80	100 (0, 266)	76
23	0.80	1227 (740, 1738)	71.9	49	0.59	155 (0, 479)	62
24	0.80	378 (220, 515)	71.7	50	0.81	134 (0, 340)	105.2
25	0.80	376 (282, 466)	75.2	51	0.89	66 (0, 161)	95.7
26	0.80	163 (23, 385)	71.1	52	0.45	0	-
				BY 2022 total		22,327	
				95% CI		(19963, 24739)	

Table 15. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI) and mean fork length (Med FL) for *O. mykiss* passing Red Bluff Diversion Dam (RK 391) for the period 1/1/2023 through 12/31/2023 (brood year 2023). Full sampling effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include total estimated passage (fry, sub-yearling and yearlings combined).

Week	Trap Effort	Total Passage (95% CI)	Mean FL (mm)	Week (cont.)	Trap Effort (cont.)	Total Passage (95% CI) (cont.)	Mean FL (mm) (cont.)
1 (Jan)	0.44	206 (0, 594)	190	27 (Jul)	1.00	2942 (2279, 3626)	71.8
2	0.00	103 (0, 297)	-	28	0.97	3384 (2648, 4202)	70.6
3	0.43	0	-	29	1.00	3714 (2989, 4448)	70.8
4	0.86	31 (0, 94)	165	30	1.00	2925 (2296, 3679)	67.1
5 (Feb)	0.83	27 (0, 81)	30	31 (Aug)	1.00	3203 (2591, 3876)	68.4
6	1.00	0	-	32	1.00	4065 (3291, 4776)	69.3
7	1.00	0	-	33	1.00	2911 (2154, 3736)	62.7
8	1.00	0	-	34	1.00	2910 (2193, 3708)	64.4
9 (Mar)	0.81	0	-	35 (Sep)	1.00	2253 (1820, 2732)	64.5
10	0.57	0	-	36	1.00	3211 (2420, 4063)	65.1
11	0.11	0	-	37	1.00	1619 (1007, 2258)	63
12	0.77	53 (0, 164)	130	38	1.00	1077 (805, 1405)	66.6
13	0.66	0	-	39	1.00	834 (535, 1116)	66.4
14 (Apr)	0.86	0	-	40 (Oct)	1.00	897 (455, 1358)	73
15	0.97	68 (0, 151)	116	41	1.00	679 (417, 875)	72.5
16	1.00	0	-	42	0.97	356 (227, 447)	72.7
17	0.43	0	-	43	1.00	235 (88, 393)	79
18 (May)	0.79	94 (0, 301)	52	44 (Nov)	0.97	241 (109, 378)	78.2
19	0.79	314 (47, 626)	57.7	45	0.89	195 (84, 303)	90.4
20	1.00	1037 (531, 1497)	66.6	46	0.89	199 (49, 388)	76.4
21	0.87	533 (279, 830)	60.1	47	0.80	131 (28, 257)	97.8
22 (Jun)	0.84	947 (577, 1318)	80.3	48 (Dec)	0.80	30 (0, 93)	80
23	0.90	1804 (1229, 2486)	71.1	49	0.86	95 (0, 230)	75
24	1.00	1383 (868, 2148)	68.9	50	0.86	29 (0, 88)	93
25	0.94	2146 (1599, 2676)	68.2	51	0.89	621 (70, 1354)	75.7
26	1.00	1894 (1196, 2648)	71.1	52	0.49	146 (0, 438)	95
				BY 2023 total		49,542	
				95% CI		(46347, 52413)	

.

Table 16. Green Sturgeon annual capture, catch per unit volume (CPUV; fish /acre-ft) and total length (mm) summaries for sturgeon captured by RBDD rotary screw-traps between calendar year (CY) 2013 and 2023.

CY	Catch	CPUV	Min TL	Max TL	Mean	Median
2013	443	2.86	20	45	28.5	27
2014	319	2.98	21	246	29.1	27
2015	515	3.25	21	54	29.7	29
2016	2,871	30.35	20	312	31.3	28
2017	4,927	29.79	17	261	29.6	27
2018	79	0.41	21	317	38.7	26
2019	4,303	22.19	17	116	28.1	27
*2020	157	1.58	23	61	26.4	26
2021	1,043	12.32	21	331	27.5	26
2022	2	0.02	89	112	100.5	100.5
2023	4,290	37.05	20	266	51.1	28
Mean	1,722.6	14.12	26.4	192.8	38.2	33.8
SD	1,961.6	14.37	20.8	115.1	21.9	22.2
CV	113.9%	101.8%	79.1%	59.7%	57.2%	65.6%

*CY2020 has incomplete data collection due to COVID-19 and is excluded from Mean, SD and CV calculations.

Table 17. Unidentified lamprey ammocoetes annual capture, catch per unit volume (CPUV; fish /acre-ft) and total length (mm) summaries for ammocoetes captured by RBDD rotary screw-traps between water year (WY) 2014 and 2023.

WY	Catch	CPUV	Min TL	Max TL	Mean	Median
2014	203	3.3	46	166	100	103
2015	826	6.3	13	142	97	102
2016	1,644	19.3	21	165	104	109
2017	4,934	34.2	8	198	93	94
2018	2,954	76.0	10	175	86	87
2019	3,006	34.5	6	177	89	90
2020*	929	22.4	38	148	90	91
2021	647	18.0	24	193	99	103
2022	759	24.3	40	175	114	114
2023	1,916	37.0	19	197	113	115
Mean	1,876.6	28.1	20.8	176.4	99.3	101.9
SD	1,520.9	21.6	14.0	18.0	9.7	10.0
CV	81.0%	77.0%	67.6%	10.2%	9.8%	9.8%

*WY2020 has incomplete data collection due to COVID-19 and is excluded from Mean, SD and CV calculations.

Table 18. Pacific Lamprey macrophthalmia and adult annual capture, catch per unit volume (CPUV; fish /acre-ft) and total length (mm) summaries for macrophthalmia captured by RBDD rotary screw-traps between water year (WY) 2014 and 2023.

WY	Catch	CPUV	Min TL	Max TL	Mean	Median
2014	1,051	88.0	85	560	137	126
2015	78	0.9	40	490	165	128
2016	2,858	105.8	98	590	130	123
2017	579	9.4	80	512	141	119
2018	4,798	265.1	80	567	125	118
2019	210	4.5	76	511	128	122
2020*	3,396	92.7	42	160	118	118
2021	6,410	477.2	62	580	119	117
2022	8,694	703.2	41	580	121	119
2023	822	37.6	87	470	129	125
Mean	2,833.3	188.0	72.1	540.0	132.8	121.9
SD	3,118.1	248.7	20.3	44.5	14.0	3.9
CV	110.0%	132.3%	28.2%	8.2%	10.5%	3.2%

*WY2020 has incomplete data collection due to COVID-19 and is excluded from Mean, SD and CV calculations.

Table 19. Summary of Coleman National Fish Hatchery brood year 2022 fall Chinook Salmon released as unmarked fry or fractionally marked smolts into the Sacramento River upstream of the RBDD transect from January 3 through May 4, 2023. Week number, release dates, total number of fish released per group, mean fork length (FL) of Chinook Salmon at release (mm), length-at-date (LAD) size ranges and percent of marked LAD fall and spring Chinook Salmon captured in the RBDD rotary screw-traps for each production release group.

Week	Release Date(s)	# Released	Mean FL (mm)	Fall LAD range	Fall % captures	Spring LAD range	Spring % captures
1	1/3/2023	605,539	30-35	0-41	unknown	--	--
3	1/17/2023	673,132	30-35	0-45	unknown	--	--
5	1/30/2023	1,487,689	30-35	0-49	unknown	--	--
13	3/29/2023	1,603,585	70	0-72	74.8%	73 - 98	25.2%
14	--	--	--	35 - 76	85.1%	77 - 103	14.9%
15	--	--	--	37 - 80	43.7%	81 - 109	56.3%
16	--	--	--	39 - 83	84.0%	84 - 112	16.0%
17	4/24/2023	9,395,063	75	40 - 87	87.1%	88 - 119	12.9%
18	5/4/2023	639,745	75	42 - 91	99.7%	92 - 123	0.3%
19	--	--	--	44 - 95	100.0%	96 - 129	0.0%
	Total:	**14,404,753**			**86.1%**		**13.9%**

Table 20. Summary of Coleman National Fish Hatchery brood year 2023 fall Chinook Salmon released as fractionally marked smolts into the Sacramento River upstream of the RBDD site from March 21 through April 12, 2024. Week number, release dates, total number of fish released per group, mean fork length (FL) of Chinook Salmon at release (mm), length-at-date (LAD) size ranges and percent of marked LAD fall and spring Chinook Salmon captured in the RBDD rotary screw-traps for each production release group.

Week	Release Date(s)	# Released	Mean FL (mm)	Fall LAD range	Fall % captures	Spring LAD range	Spring % captures
12	3/21/2024	2,848,706	75	0 - 69	0.0%	70 - 93	100.0%
13	3/27/2024	1,569,983	75	0 - 72	26.5%	73 - 98	73.5%
14	--	--	--	35 - 76	35.4%	77 - 103	64.6%
15	4/12/2024	2,761,760	75	37 - 80	30.6%	81 - 109	69.4%
16	--	--	--	39 - 83	76.2%	84 - 112	23.8%
17	--	--	--	40 - 87	54.5%	88 - 119	45.5%
18	--	--	--	42 - 91	55.2%	92 - 123	44.8%
19	--	--	--	44 - 95	85.6%	96 - 129	14.4%
	Total:	**7,180,449**			**53.2%**		**46.8%**

Figures

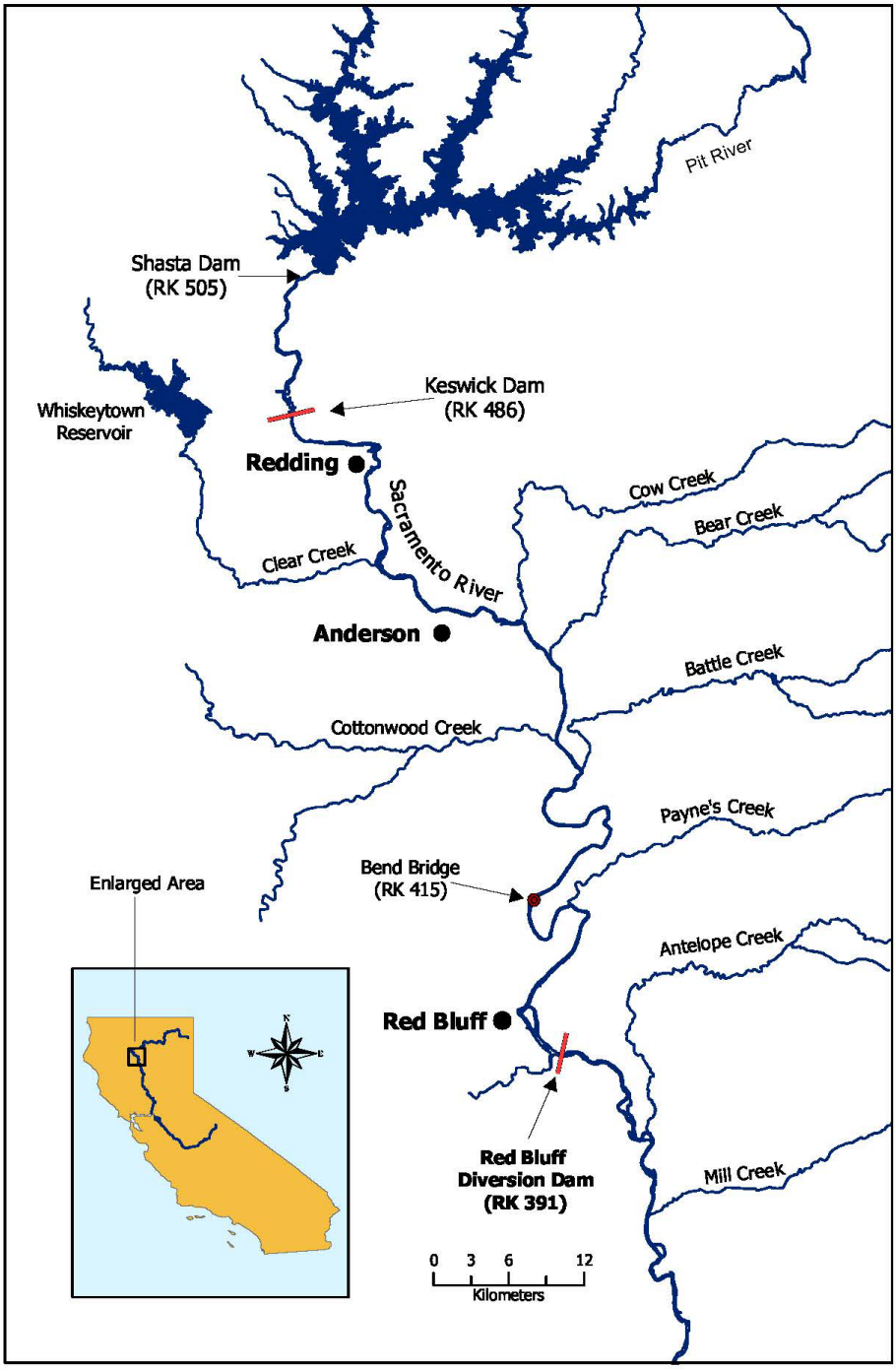

Figure 1. Location of Red Bluff Diversion Dam sample site on the Sacramento River, California, at river kilometer 391 (RK 391).

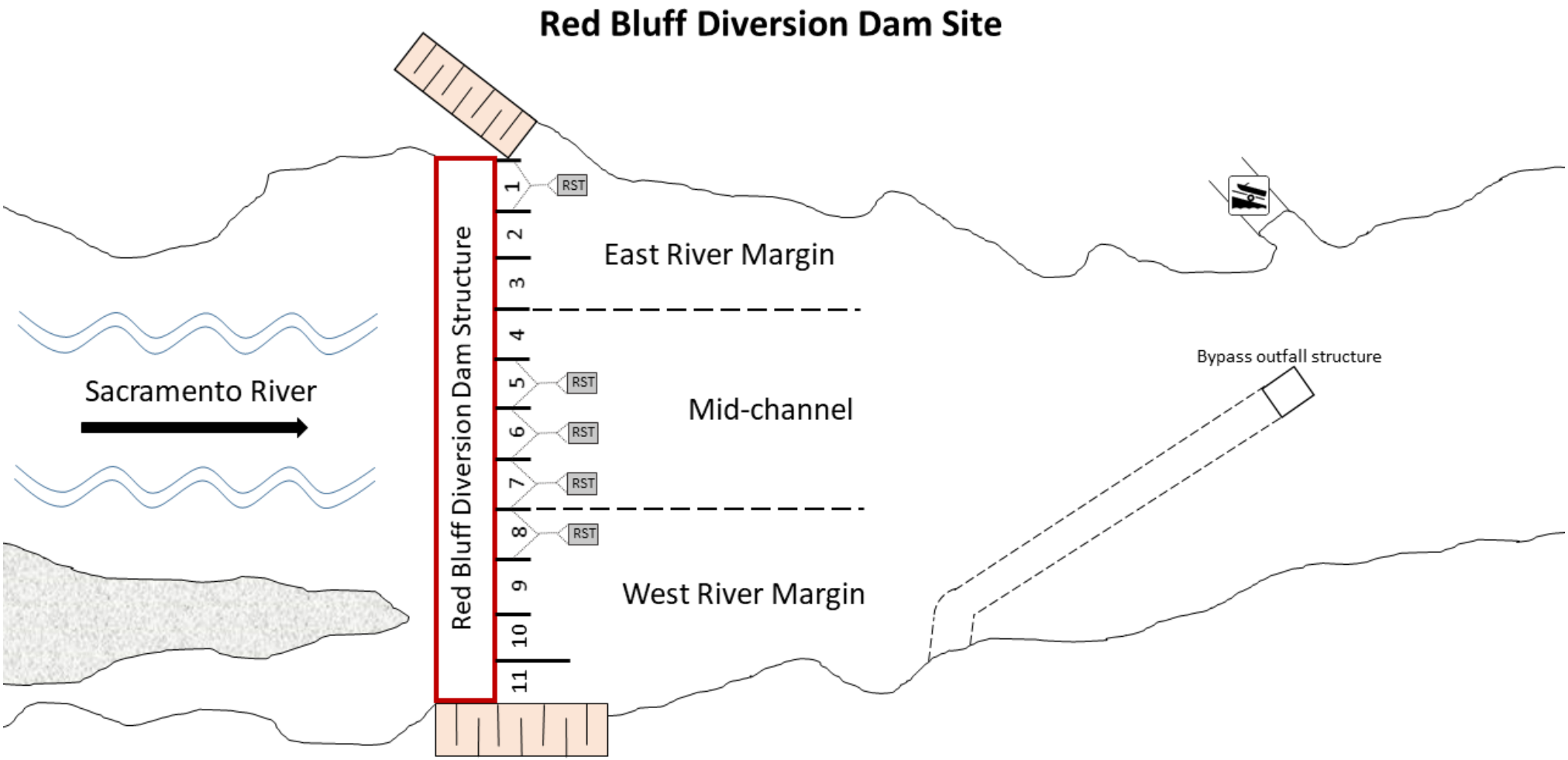

Figure 2. Rotary-screw trap sampling transect schematic of Red Bluff Diversion Dam site (RK 391) on the Sacramento River, CA.

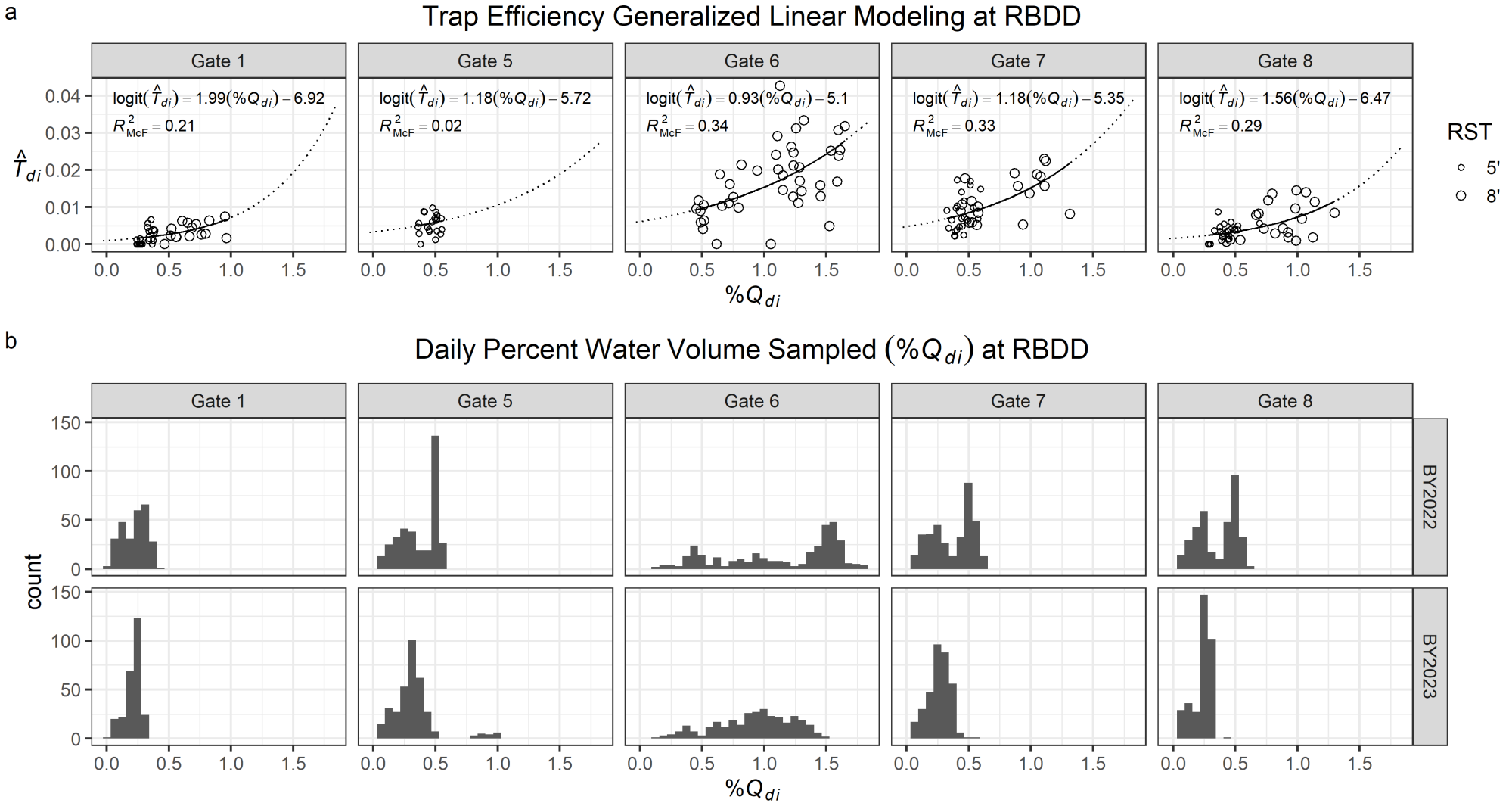

Figure 3. Generalized linear models of trap efficiency (a) for (4) 1.5-m and (1) 2.4-m diameter rotary-screw trap at Red Bluff Diversion Dam (RK391), Sacramento River, CA. Mark-recapture trials by gate between 2018 and 2023 were used to estimate individual trap efficiencies. Trials were conducted using either 2.4 m traps (n=20) or (1) 2.4-m and (4)-1.2 m traps (n=24). Histograms (b) of daily percent water volume sampled by each trap for brood year 2022 and 2023.

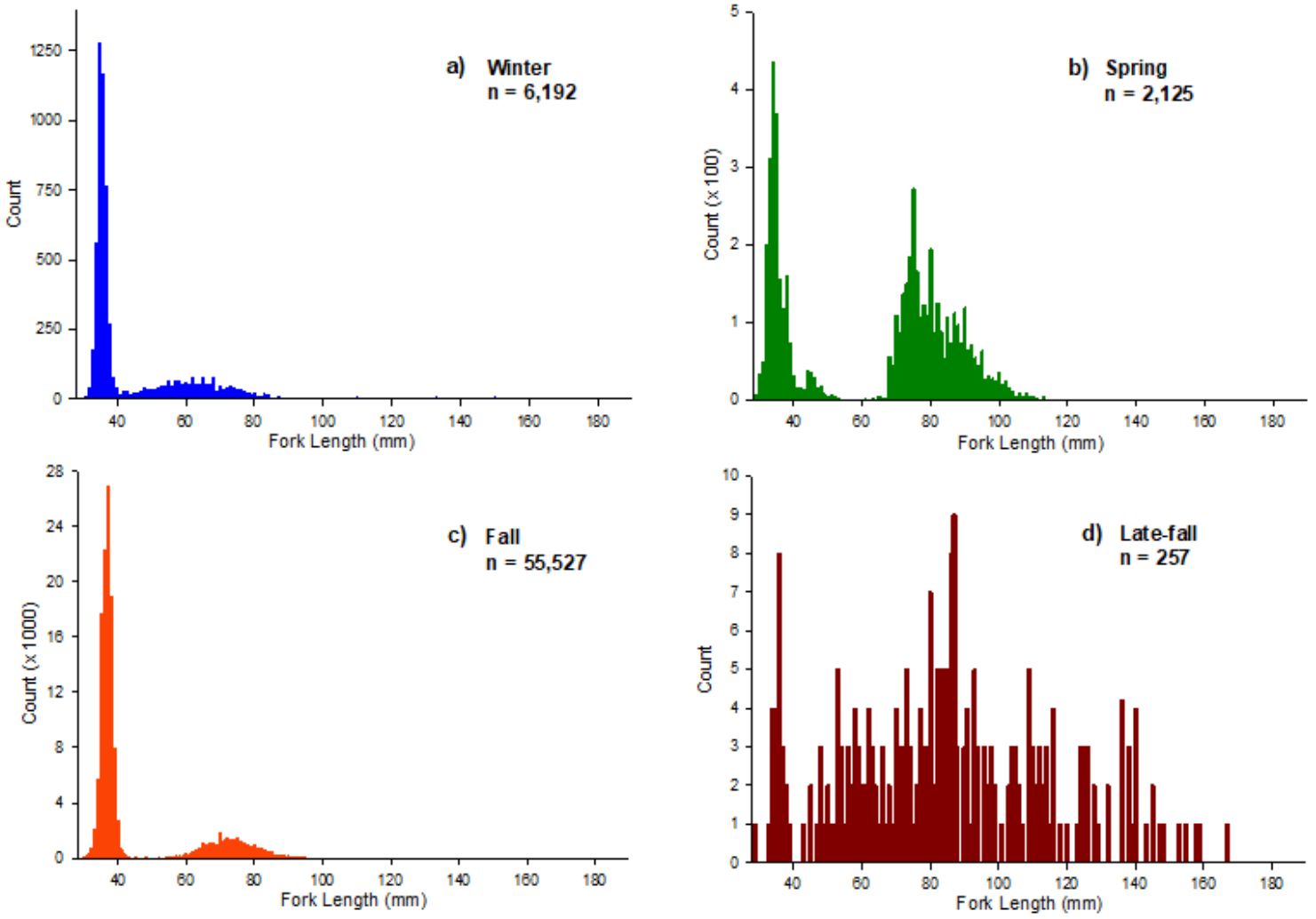

Figure 4. Fork length frequency distribution of brood year 2022 juvenile a) winter, b) spring, c) fall and d) late-fall Chinook Salmon sampled by rotary-screw traps at Red Bluff Diversion Dam (RK 391), Sacramento River, California. Fork length data were expanded to unmeasured individuals when sub-sampling protocols were implemented. Sampling was conducted from 4/1/2022 through 11/30/2023.

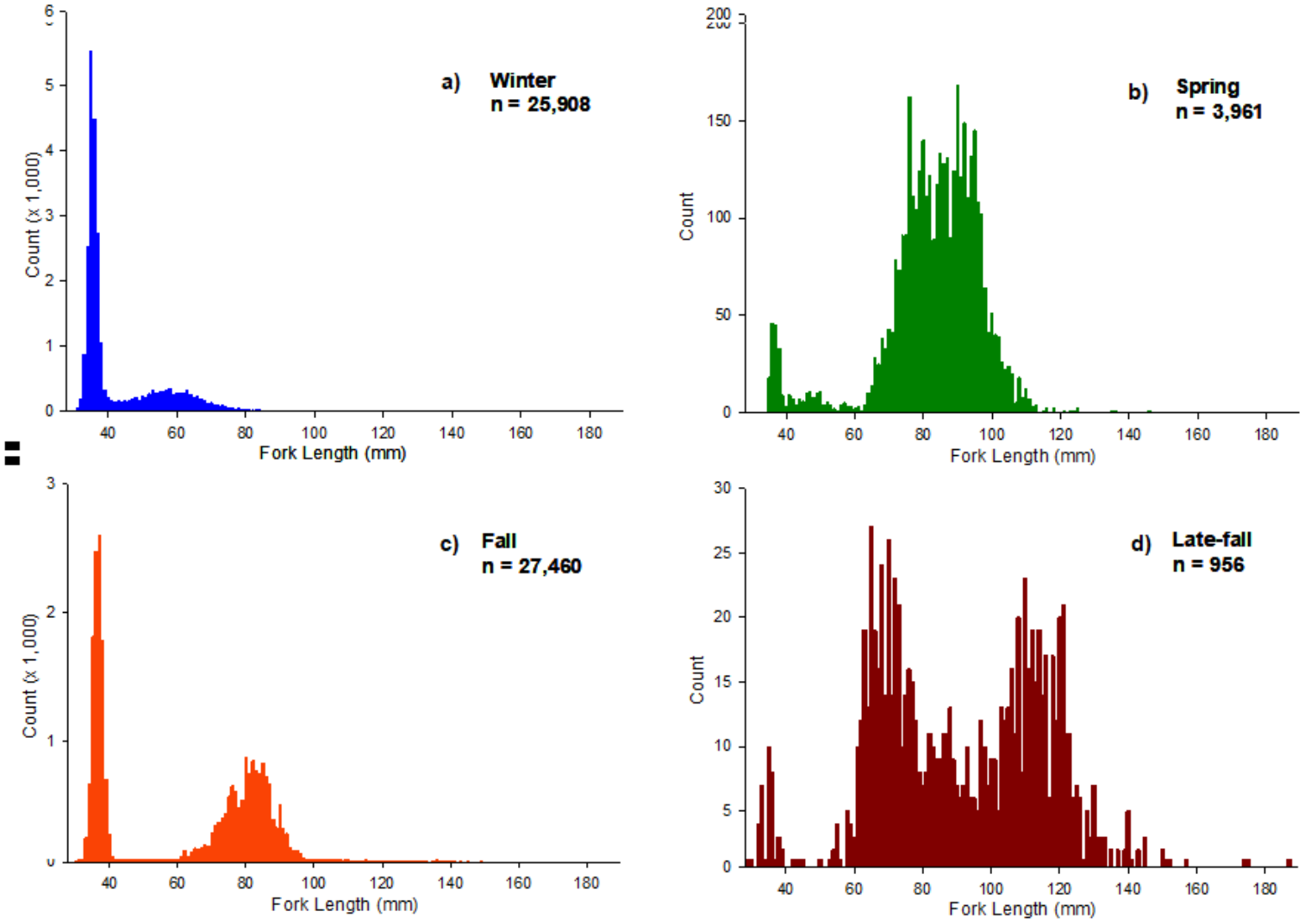

Figure 5. Fork length frequency distribution of brood year 2023 juvenile a) winter, b) spring, c) fall and d) late-fall Chinook Salmon sampled by rotary-screw traps at Red Bluff Diversion Dam (RK 391), Sacramento River, California. Fork length data were expanded to unmeasured individuals when sub-sampling protocols were implemented. Sampling was conducted from 4/1/2023 through 11/30/2024.

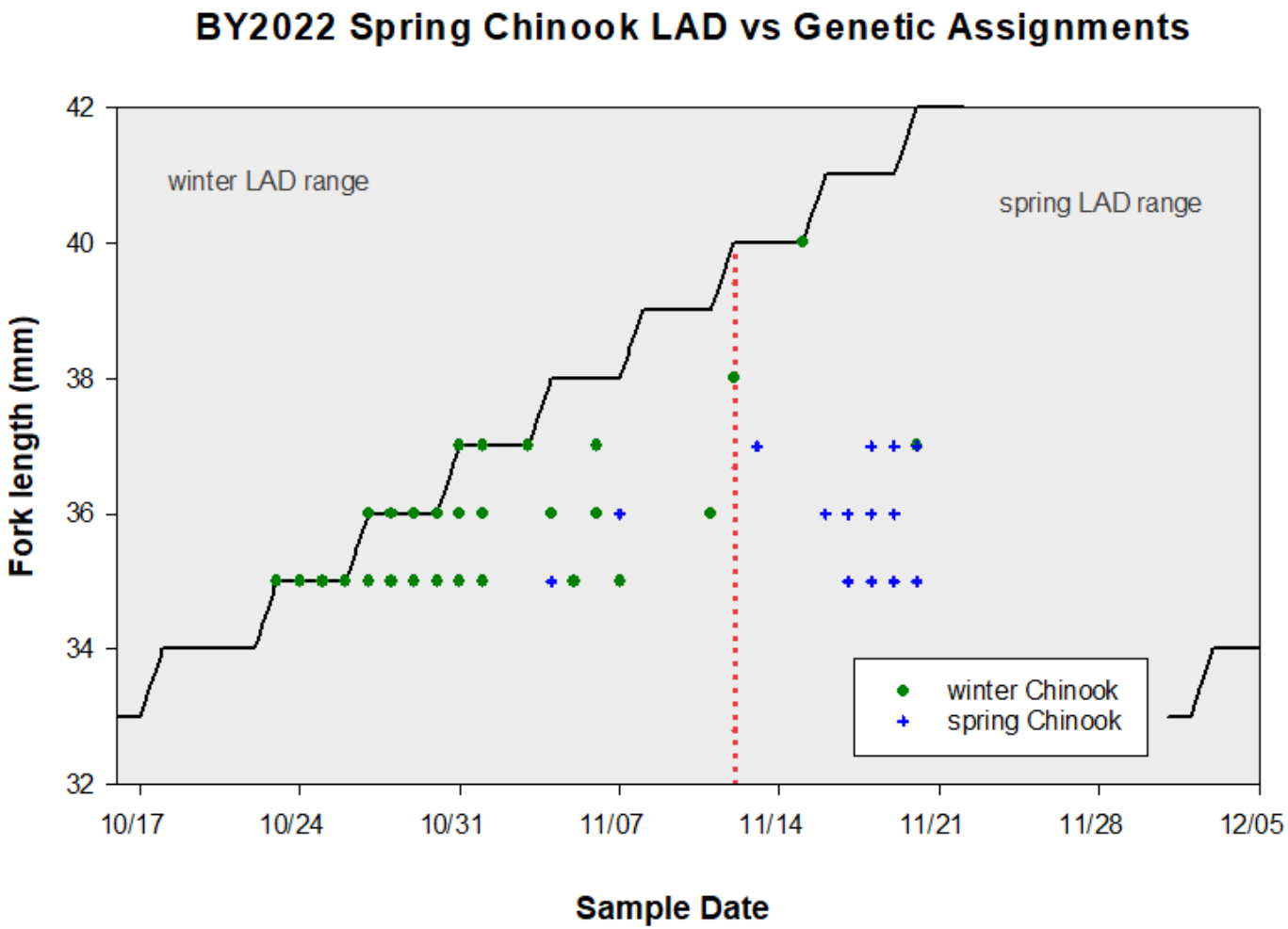

Figure 6. Genetic assignment results from brood year 2022 spring Chinook Salmon length-at-date (LAD) samples collected from 10/23/2022 through 11/30/2022. Solid black line represents upper and lower LAD range by date and genetic assignments are displayed by color and symbol. Week 46 or 11/12/2022 was identified as the start of BY2022 spring Chinook Salmon passage at RBDD based on genetic assignments. All LAD spring Chinook Salmon re-assigned to winter Chinook Salmon prior to 11/12/2022.

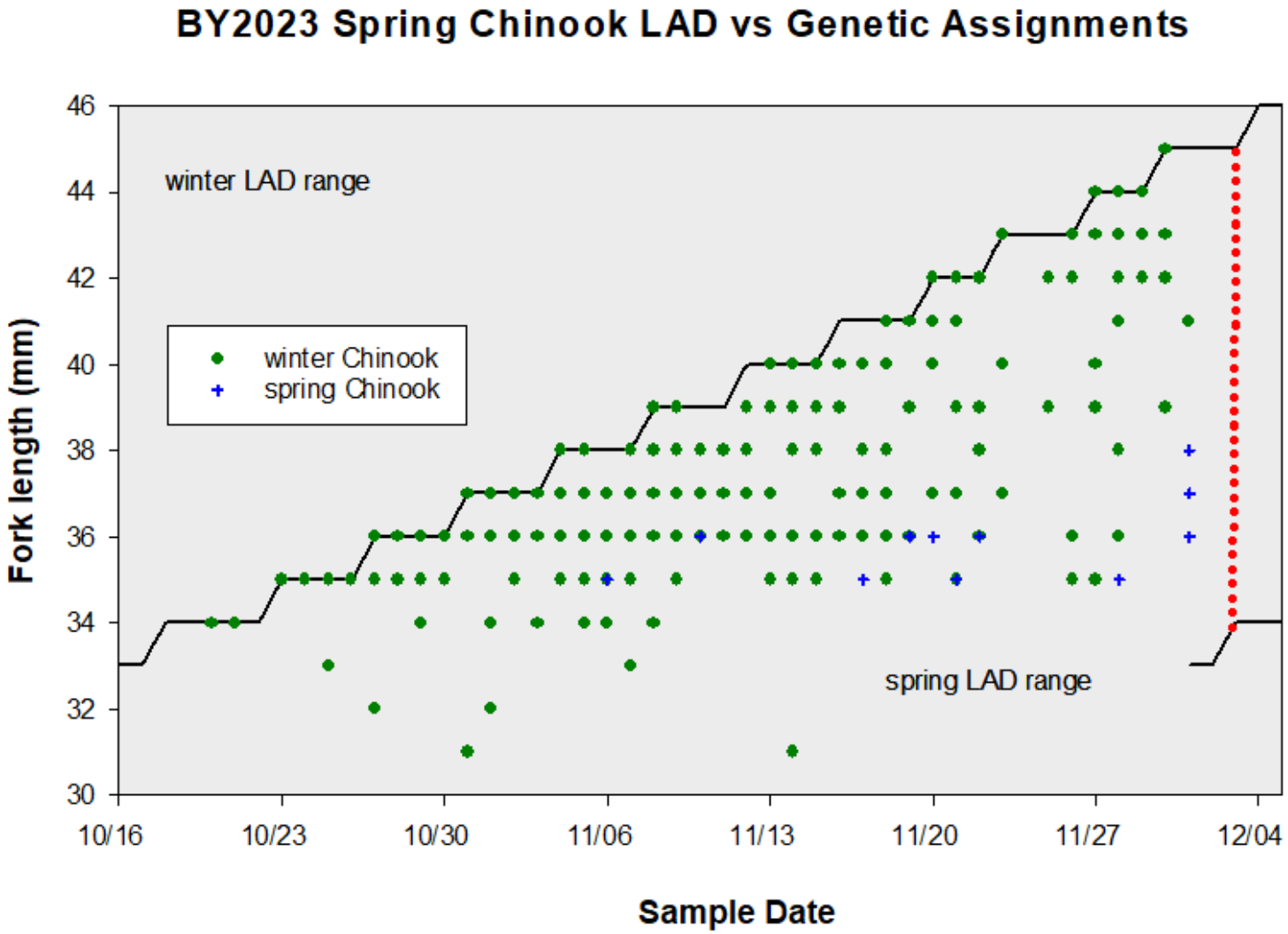

Figure 7. Genetic assignment results from brood year 2023 spring Chinook Salmon length-at-date (LAD) samples collected from 10/20/2023 through 12/01/2023. Solid black line represents upper and lower LAD range by date. Genetic assignments are displayed by color and symbol. Week 49 or 12/3/2023 was identified as the start of BY2023 spring Chinook Salmon passage at RBDD based on genetic assignments. All LAD spring Chinook Salmon re-assigned to winter Chinook Salmon prior to 12/3/2023.

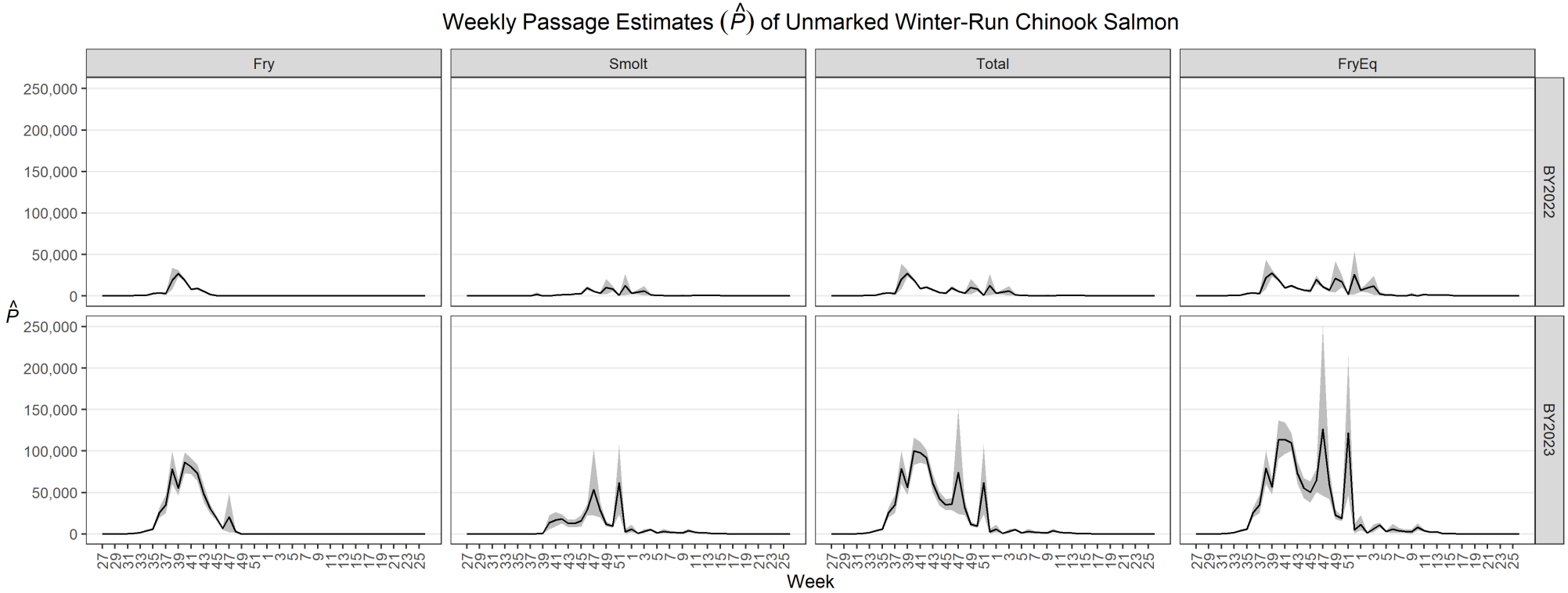

Figure 8. Weekly estimated passage with 95% confidence intervals (shaded area) of brood year 2022 and 2023 juvenile winter Chinook Salmon passing Red Bluff Diversion Dam (RK 391), Sacramento River, California. Winter Chinook Salmon were sampled by rotary-screw traps for the period 7/1/2022 through 6/30/2024.

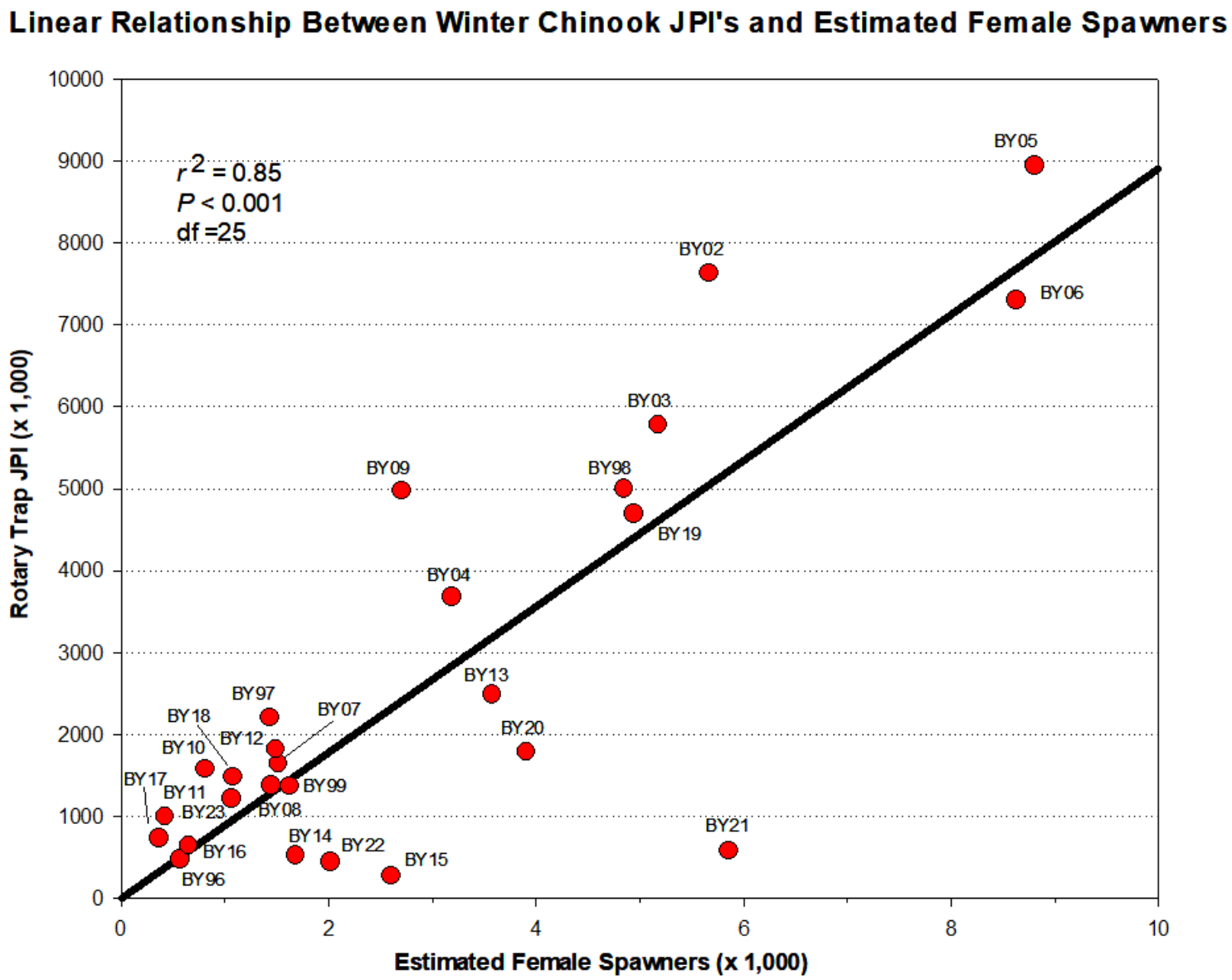

Figure 9. Linear relationship between rotary-screw trap juvenile winter Chinook Salmon fry-equivalent production indices (Rotary Trap JPI) and carcass survey derived estimated female spawners.

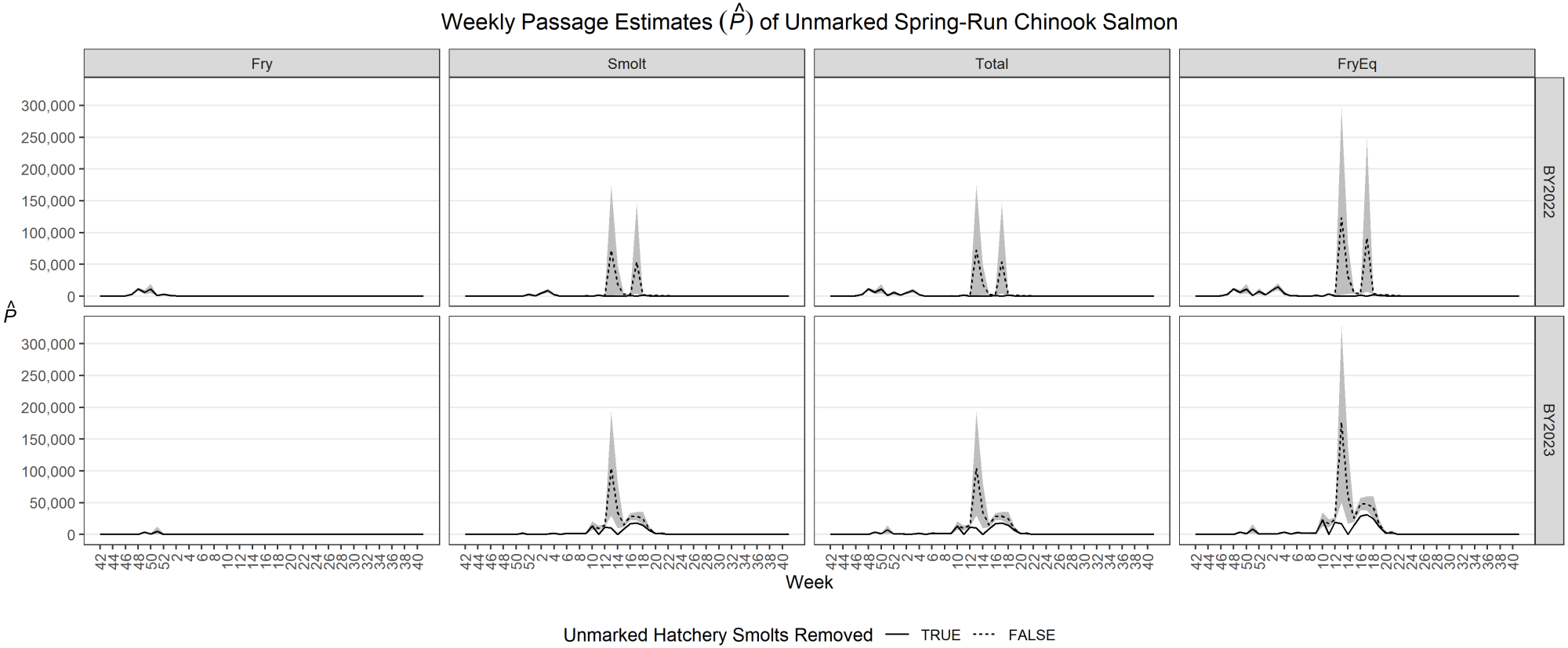

Figure 10. Weekly estimated passage and 95% confidence intervals (shaded area) of brood year 2022 and 2023 mark-corrected (solid line) juvenile spring Chinook Salmon passing Red Bluff Diversion Dam (RK 391), Sacramento River, California. Spring Chinook Salmon were sampled by rotary-screw traps for the period 10/16/2022 through 10/15/2024. Dotted line represents total passage of LAD spring Chinook Salmon that include unmarked CNFH hatchery fall Chinook Salmon.

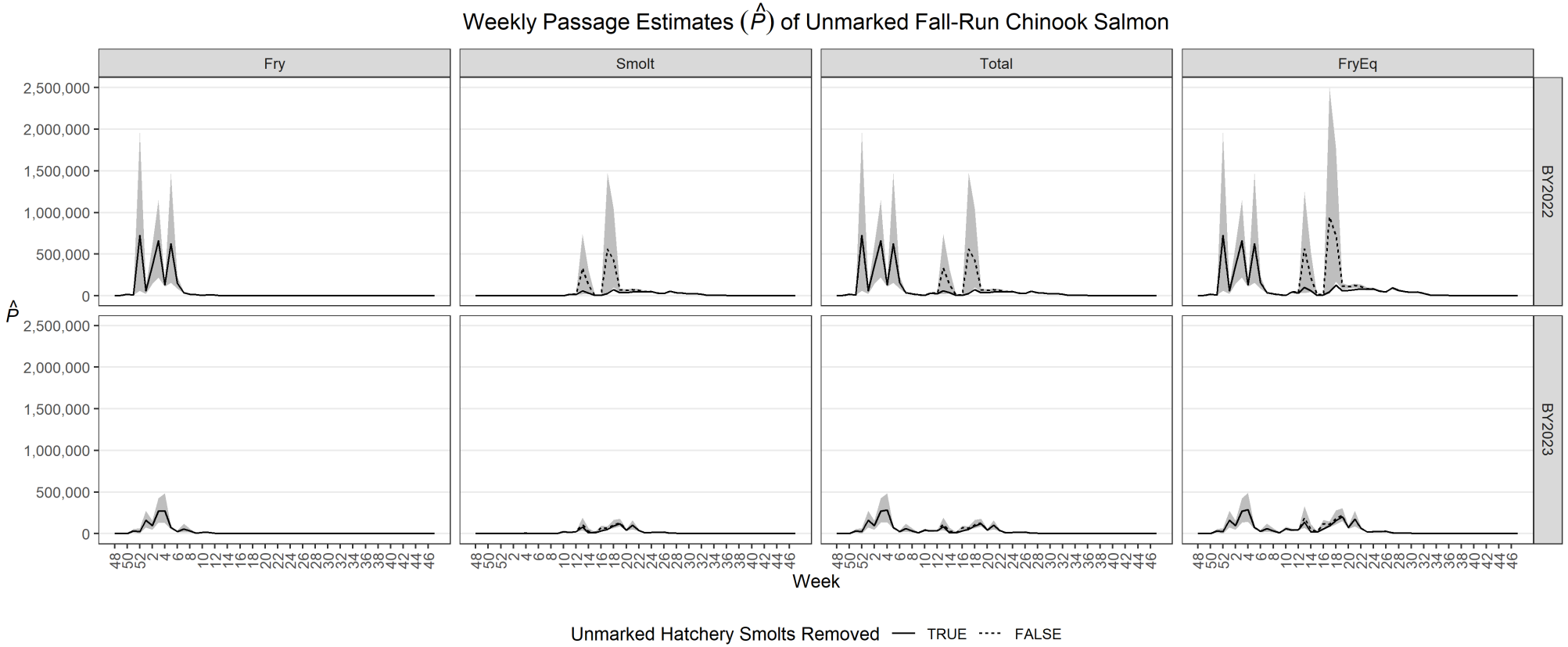

Figure 11. Weekly estimated passage and 95% confidence intervals (shaded area) of brood year 2022 and 2023 mark-corrected (solid line) juvenile fall Chinook Salmon passing Red Bluff Diversion Dam (RK 391), Sacramento River, California. Fall Chinook Salmon were sampled by rotary-screw traps for the period 12/1/2022 through 11/30/2024. Dotted line represents total passage of LAD fall Chinook Salmon that include unmarked CNFH hatchery fall Chinook Salmon. Three sharp peaks in abundance within the BY 2022 "Fry" sub-panel indicate passage of *unmarked* CNFH unfed-fry released from 1/3/2023 to 1/30/2023 at Balls Ferry boat ramp (RK 445).

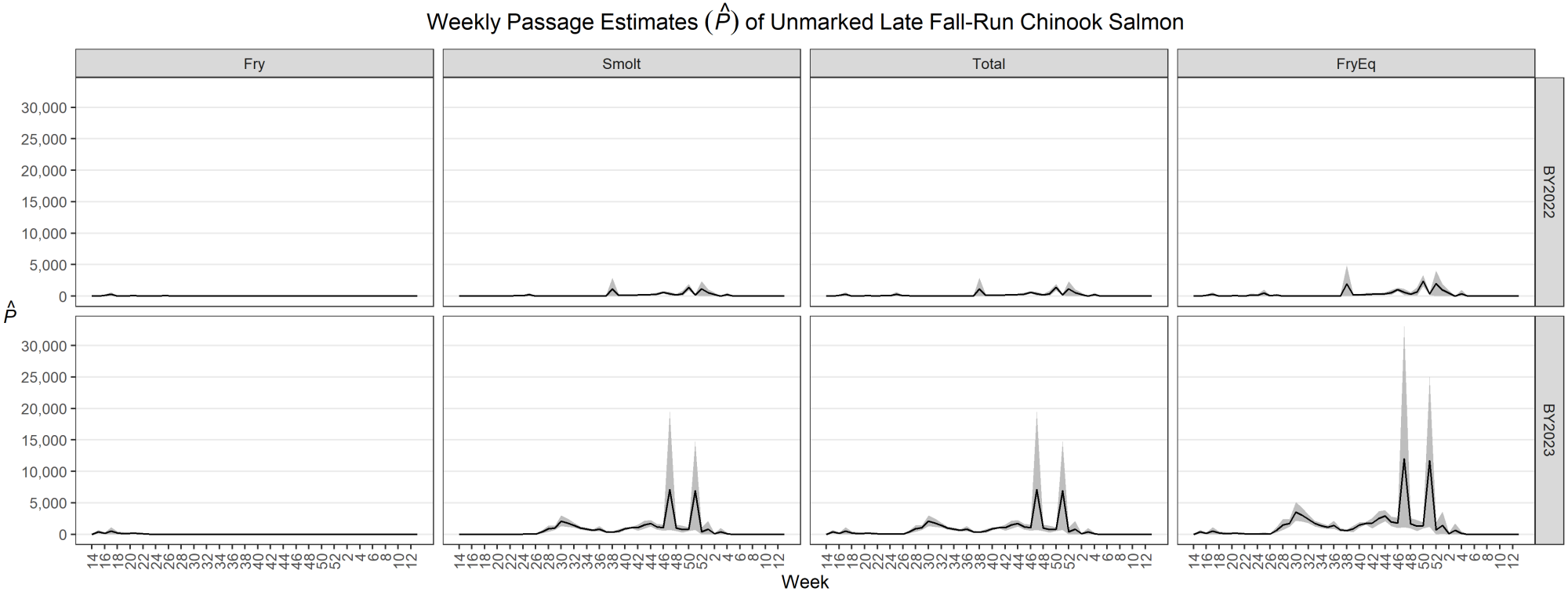

Figure 12. Weekly estimated passage (solid line) and 95% confidence intervals (shaded area) of brood year 2022 and 2023 juvenile late-fall Chinook Salmon passing Red Bluff Diversion Dam (RK 391), Sacramento River, California. Late-fall Chinook Salmon were sampled by rotary-screw traps for the period 4/1/2022 through 3/31/2024.

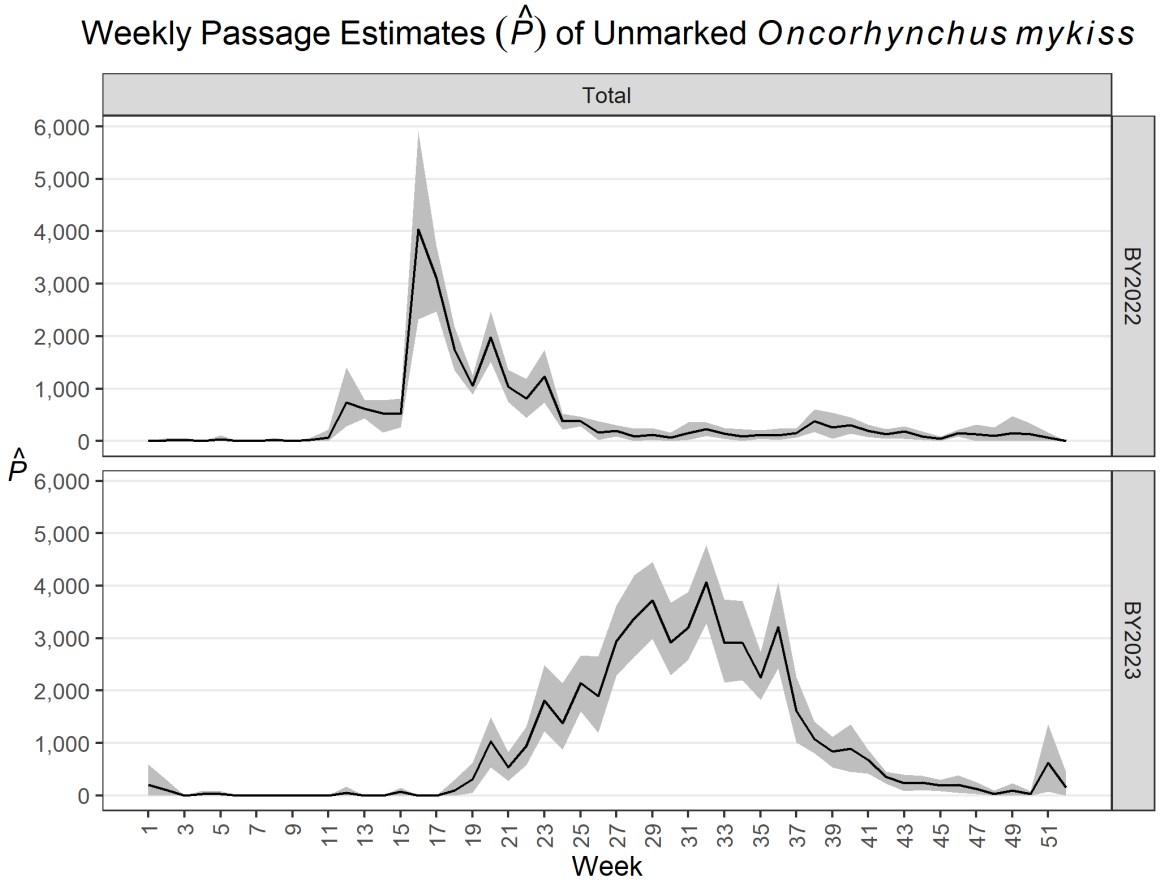

Figure 13. Weekly estimated passage (solid line) and 95% confidence intervals (shaded area) of calendar year 2022 and 2023 juvenile *O. mykiss* passing Red Bluff Diversion Dam (RK 391), Sacramento River, California. *O. mykiss* were sampled by rotary-screw traps for the period 1/1/2022 through 12/31/2023.

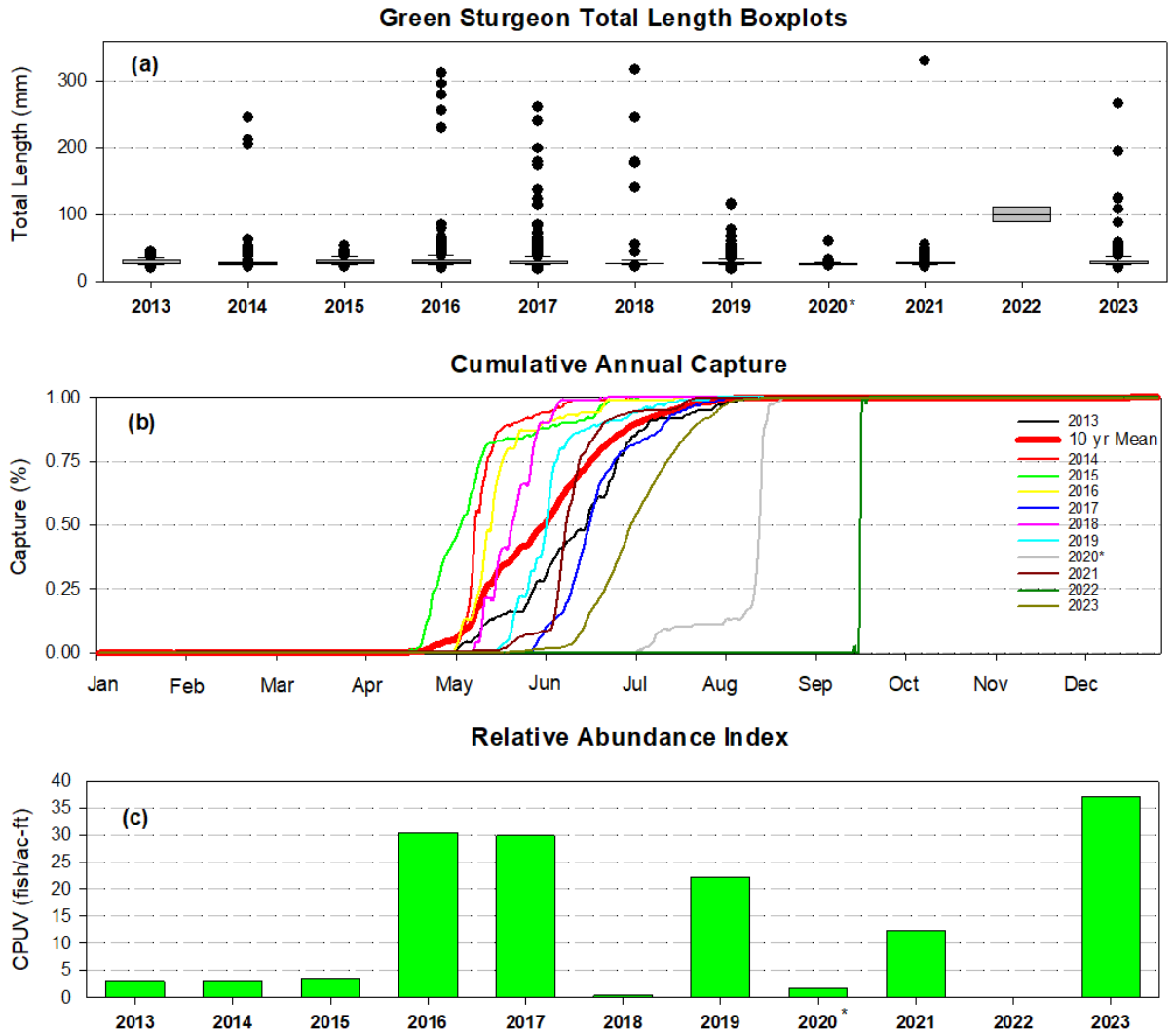

Figure 14. Green Sturgeon a) annual total length capture boxplots, b) annual cumulative capture trends with 10-year mean trend line, and c) relative abundance indices. All fish captured by rotary screw-trap at RBDD (RK 391) on the upper Sacramento River, CA between 2013 and 2023. *Calendar year 2020 included a period of no sampling from 3/25/2020-6/30/2020 due to COVID-19 pandemic.

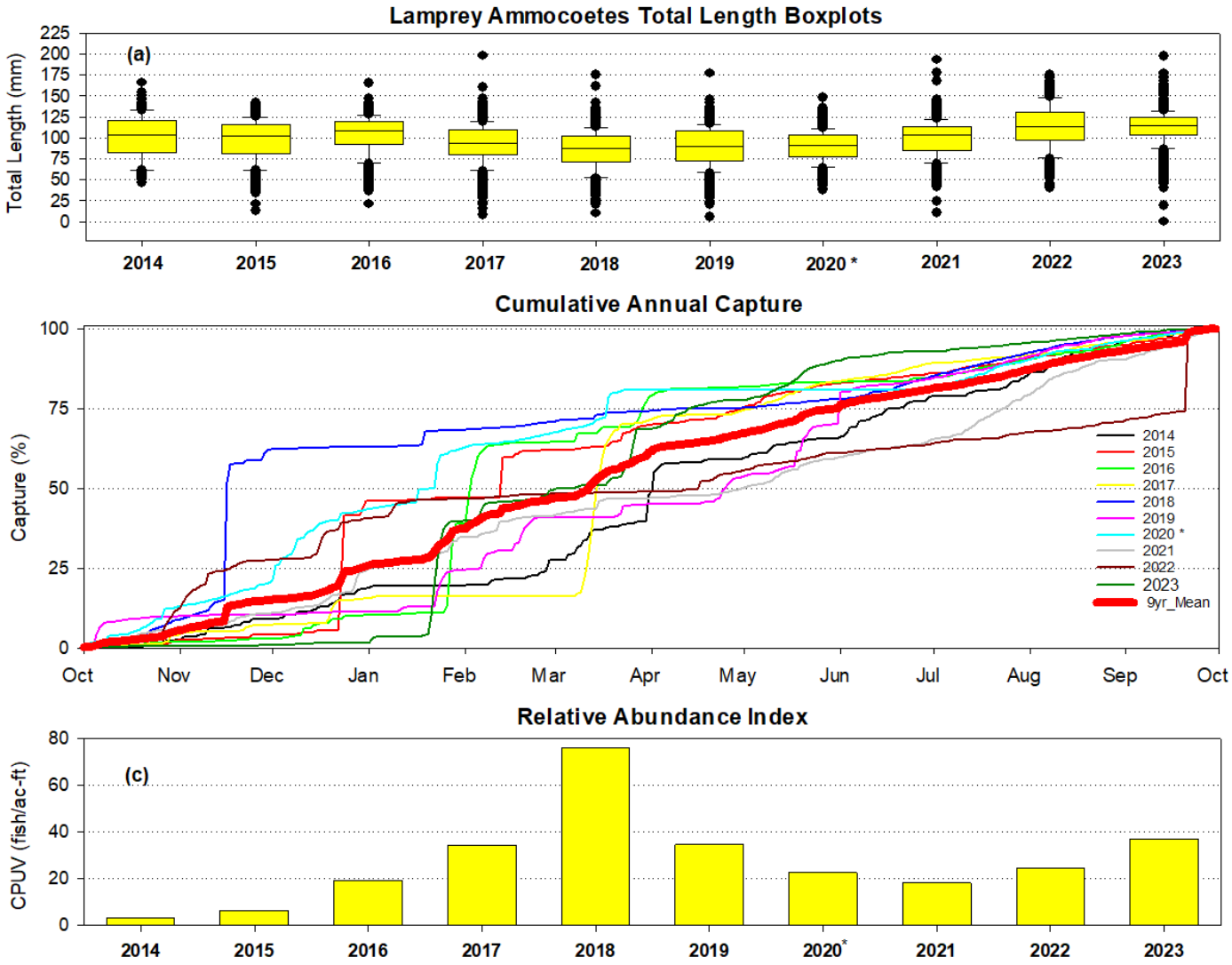

Figure 15. Unidentified lamprey ammocoetes a) total length distribution box plots, b) cumulative annual capture trends, and c) relative abundance indices from rotary screw-traps collected between 10/1/2013 and 9/30/2023 by water year from the Sacramento River, CA at the RBDD (RK 391). *Water year 2020 included a period of no sampling from 3/25/2020 to 6/30/2020 due to the COVID-19 pandemic.

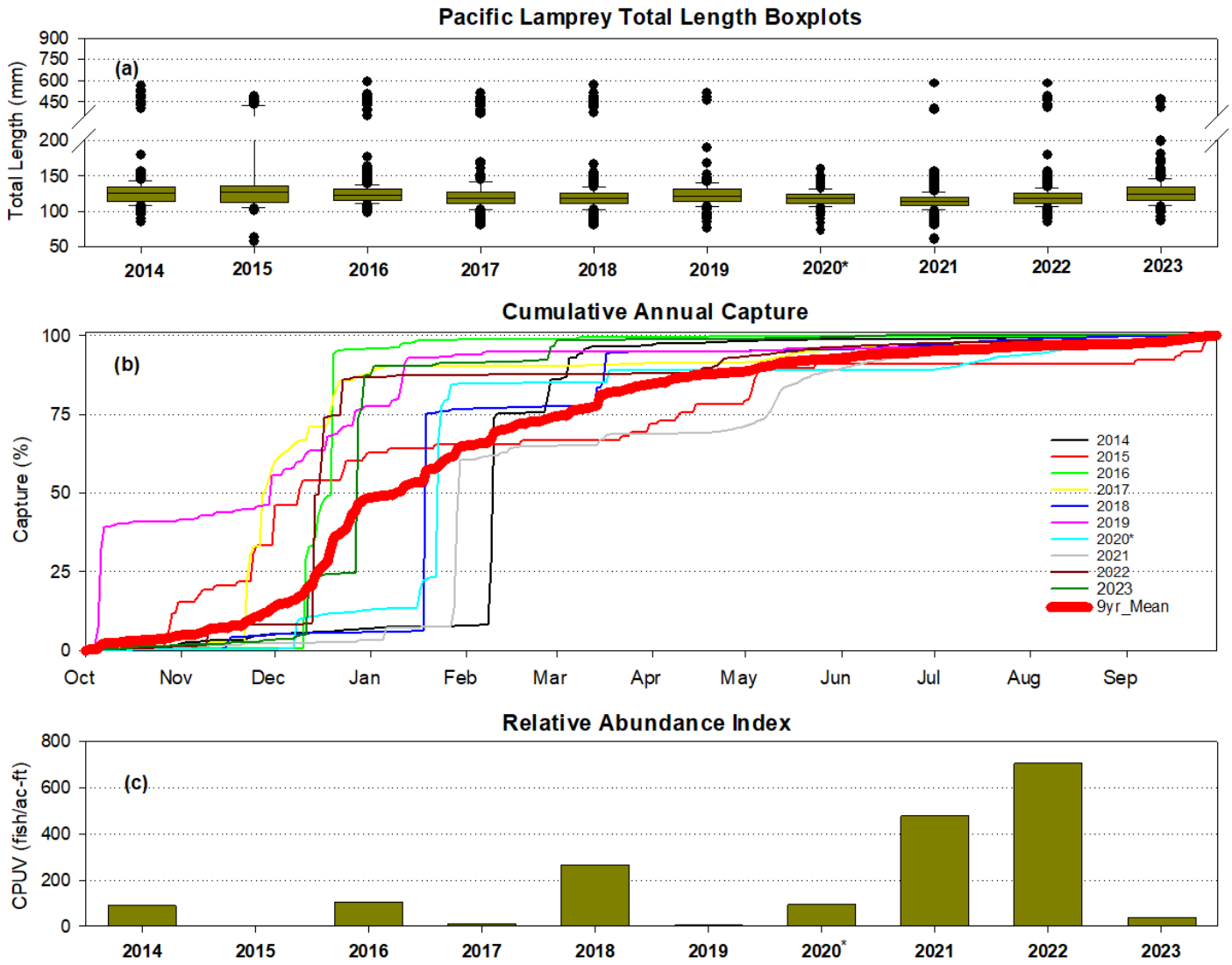

Figure 16. Pacific Lamprey (macrophthalmia and adults) a) total length distribution box plots, b) cumulative annual capture trends, and c) relative abundance indices from rotary screw-traps collected between 10/1/2013 and 9/30/2023 by water year from the Sacramento River, CA at the RBDD (RK 391). *Water year 2020 included a period of no sampling from 3/25/2020 to 6/30/2020 due to the COVID-19 pandemic.

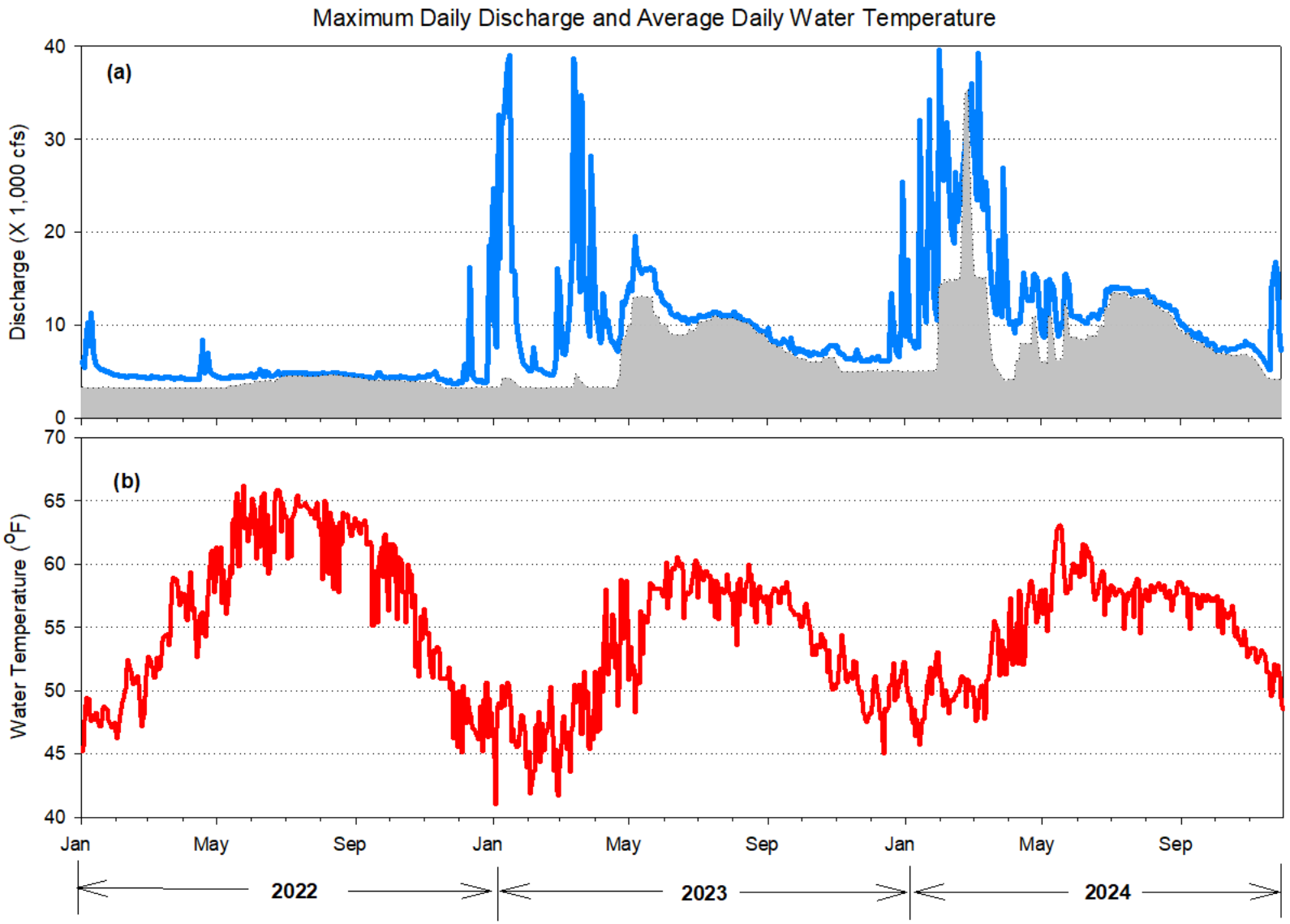

Figure 17. Sacramento River maximum daily discharge (a) observed at the California Data Exchange Center's Bend Bridge gauging station (blue line) showing water releases from Keswick Reservoir (gray shaded area) and average daily water temperatures (b) at RBDD for the period 1/1/2022 through 11/30/2024.

Appendix A. Genetic sampling and run assignment methodology

(S. Blankenship, Cramer Fish Sciences, pers. communication 2019)

Appendix A**.** Genetic sampling and run assignment methodology (S. Blankenship, Cramer Fish Sciences, pers. communication 2019)

Genetic samples were genotyped using multi-locus single nucleotide polymorphisms (SNP's). The methods used to determine SNP genotypes were allele-specific polymerase chain reaction (ASP) and amplicon sequencing (GTSeq). Specific assays for each locus were developed by NOAA Southwest Fisheries Science Center (Clemento et al. 2011) and SNPType™ assays were obtained from Fluidigm Corp. (South San Francisco, CA) when conducting ASP. These same loci are available for use within a sequencing-based approach termed GTSeq (Campbell et al. 2014). Approximately 25% of the samples were genotyped using ASP and 75% using GTSeq, with the primary decision point being time. ASP is a faster process and is used in-season to report populations assignment. GTSeq is more amendable to post-season analysis. All laboratory procedures followed Blankenship et al. (2013). All genotypes were translated into HapMap nucleotide standards (A=1, C=2, G=3, T=4, insertion/deletion=5, and no data=0). Established QA/QC procedures and scoring rules were followed for each locus.

The genetic loci used were predominantly those markers that comprised the reference baseline constructed by NOAA Southwest Fisheries Science Center (Clemento et al. 2011). In total, 91 genetic loci overlap between the SNPType™ marker set and reference baselines. Population composition of mixture collections (i.e., captured juveniles) were estimated by using a partial Bayesian procedure based on the likelihood of unknown-origin genotypes being derived from genetic baseline reference populations given the allele frequencies for reference populations. The mixed stock analysis (MSA) procedure followed Blankenship et al. (2013), which results in a maximum likelihood solution for stock composition (Millar, 1987). Assignment posterior probabilities for a given genotype are estimated for each reference collection and reported by standard population aggregations (i.e., Winter; Spring; Fall/Late-Fall). We accomplished this by extracting the assignment data from the MSA and summing the final posterior probabilities over reference populations within a reporting group. Population assignment was conducted using the ONCOR software (Steven Kalinowski unpublished, Montana State University).

Appendix B. Revised Brood year 2020 and 2021 Mark and Genetic Corrected Juvenile Salmonid

Weekly Passage Estimate Tables Based on 44-Trial Trap Efficiency GLMs

Appendix B. List of Tables

Table **Page**

Appendix B. List of Tables continued

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Table B1. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for winter Chinook Salmon passing RBDD (RK 391) for the period 7/1/2020 through 6/30/2021 (brood year 2020). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents and include genetic corrections. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of the fry to pre-smolt/smolt survival rate (44.75% or ~2.234:1; O'Farrell 2018).

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
27 (Jul)	1.00	108 (0, 334)	0	108 (0, 334)	33.7	108 (0, 334)
28	1.00	1255 (764, 1803)	0	1255 (764, 1803)	33.3	1255 (764, 1803)
29	1.00	1316 (994, 1640)	0	1316 (994, 1640)	33.9	1316 (994, 1640)
30	0.86	1727 (929, 2515)	0	1727 (929, 2515)	34.6	1727 (929, 2515)
31 (Aug)	1.00	1309 (870, 1838)	0	1309 (870, 1838)	34.5	1309 (870, 1838)
32	1.00	3642 (2424, 4813)	0	3642 (2424, 4813)	34	3642 (2424, 4813)
33	0.97	7530 (4881, 10712)	0	7530 (4881, 10712)	34.5	7530 (4881, 10712)
34	1.00	8731 (6899, 10827)	0	8731 (6899, 10827)	34.2	8731 (6899, 10827)
35 (Sep)	1.00	16574 (12765, 20996)	32 (0, 98)	16606 (12827, 21028)	34.8	16646 (12876, 21040)
36	1.00	35244 (29399, 42243)	28 (0, 88)	35273 (29399, 42329)	35.1	35307 (29399, 42433)
37	1.00	71223 (58572, 86016)	294 (148, 446)	71517 (58824, 86368)	35.7	71880 (59136, 86871)
38	1.00	119288 (101013, 137603)	21377 (6658, 35660)	140664 (111767, 169869)	37	167058 (123247, 213048)
39	1.00	147160 (129911, 166472)	33022 (21570, 41195)	180182 (161244, 202724)	38.9	220952 (193384, 251496)
40 (Oct)	1.00	74562 (56541, 95587)	15745 (6639, 27168)	90306 (64075, 121665)	41.6	109746 (72843, 154230)
41	0.97	140775 (124122, 159765)	50807 (39127, 63838)	191582 (163956, 222939)	43.6	254310 (212666, 300806)
42	1.00	105652 (80743, 134264)	44426 (33249, 60806)	150078 (115346, 192866)	43.6	204928 (157763, 267426)
43	1.00	67715 (56420, 80711)	54067 (50752, 57522)	121782 (108643, 137062)	47.5	188535 (172245, 206839)
44 (Nov)	0.97	23442 (14128, 34401)	31007 (20733, 42248)	54450 (34848, 76319)	49	92731 (60296, 127989)
45	0.97	7460 (6606, 8303)	14472 (12042, 17445)	21932 (19141, 25339)	49.1	39800 (34049, 46856)
46	1.00	4347 (3193, 5545)	17572 (15305, 20009)	21919 (19280, 24571)	51.7	43614 (38298, 49200)
47	0.97	706 (374, 1013)	22517 (15762, 29390)	23223 (16445, 30181)	57.8	51023 (35843, 66464)
48 (Dec)	0.71	508 (32, 1160)	23876 (20376, 27671)	24383 (20748, 28362)	60.1	53862 (45971, 62493)
49	1.00	0	21183 (15978, 27040)	21183 (15978, 27040)	61	47336 (35705, 60426)
50	0.91	0	6478 (4095, 8607)	6478 (4095, 8607)	62.5	14476 (9150, 19234)
51	1.00	0	5669 (3683, 7814)	5669 (3683, 7814)	65.1	12668 (8230, 17461)
52	0.78	0	15026 (5807, 25674)	15026 (5807, 25674)	68.9	33578 (12978, 57372)

Table B1. (continued)

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
1 (Jan)	0.96	0	24583 (1046, 61567)	24583 (1046, 61567)	71.1	54934 (2337, 137581)
2	0.91	0	3175 (1659, 4883)	3175 (1659, 4883)	75.6	7095 (3707, 10912)
3	1.00	0	2666 (1569, 4097)	2666 (1569, 4097)	77.8	5958 (3506, 9155)
4	0.93	0	4731 (1602, 9231)	4731 (1602, 9231)	80.8	10572 (3580, 20627)
5 (Feb)	0.79	0	8759 (2440, 19058)	8759 (2440, 19058)	81.6	19573 (5452, 42588)
6	0.94	0	628 (205, 1101)	628 (205, 1101)	94.4	1403 (458, 2460)
7	0.90	0	34 (0, 104)	34 (0, 104)	100	76 (0, 232)
8	0.94	0	198 (124, 258)	198 (124, 258)	103.6	442 (277, 577)
9 (Mar)	1.00	0	60 (18, 113)	60 (18, 113)	121.7	134 (40, 253)
10	1.00	0	65 (0, 158)	65 (0, 158)	108	145 (0, 353)
11	0.74	0	647 (0, 1939)	647 (0, 1939)	106	1446 (0, 4333)
12	0.51	0	0	0	-	0
13	0.80	0	88 (0, 199)	88 (0, 199)	131	197 (0, 445)
14 (Apr)	0.40	0	0	0	-	0
15	0.39	0	0	0	-	0
16	0.80	0	71 (0, 161)	71 (0, 161)	139.5	159 (0, 360)
17	0.87	0	77 (0, 172)	77 (0, 172)	132.5	172 (0, 384)
18 (May)	0.81	0	0	0	-	0
19	0.79	0	0	0	-	0
20	0.77	0	0	0	-	0
21	0.86	0	0	0	-	0
22 (Jun)	0.83	0	0	0	-	0
23	0.89	0	0	0	-	0
24	0.74	0	0	0	-	0
25	0.77	0	0	0	-	0
26	0.80	0	0	0	-	0
BY 2020 total		840,274	423,380	1,263,653		1,786,374
95% CI		(790377, 892367)	(379680, 474588)	(1185885, 1349447)		(1659334, 1928575)

Table B2. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for winter Chinook Salmon passing RBDD (RK 391) for the period 7/1/2021 through 6/30/2022 (brood year 2021). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents and include genetic corrections. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of the fry to pre-smolt/smolt survival rate (44.29% or ~2.258:1; O'Farrell 2018).

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
27 (Jul)	0.54	292 (132, 460)	0	292 (132, 460)	33.2	292 (132, 460)
28	0.80	205 (61, 405)	0	205 (61, 405)	33.8	205 (61, 405)
29	0.80	493 (256, 744)	0	493 (256, 744)	34.3	493 (256, 744)
30	0.80	2095 (1540, 2623)	0	2095 (1540, 2623)	34.4	2095 (1540, 2623)
31 (Aug)	0.80	2789 (1720, 4094)	0	2789 (1720, 4094)	35.2	2789 (1720, 4094)
32	0.83	5163 (3095, 7457)	0	5163 (3095, 7457)	35.7	5163 (3095, 7457)
33	0.89	5607 (4575, 6715)	0	5607 (4575, 6715)	35.5	5607 (4575, 6715)
34	0.86	5506 (4658, 6402)	0	5506 (4658, 6402)	35.2	5506 (4658, 6402)
35 (Sep)	0.86	12614 (7326, 20182)	28 (0, 86)	12642 (7397, 20188)	35.7	12677 (7462, 20204)
36	1.00	32718 (24475, 41132)	55 (0, 117)	32772 (24560, 41146)	35.6	32842 (24647, 41197)
37	1.00	45835 (38663, 52956)	391 (165, 639)	46226 (39074, 53287)	36.6	46718 (39541, 53728)
38	1.00	43460 (37579, 50222)	1069 (769, 1356)	44529 (38447, 51503)	37.6	45874 (39593, 53043)
39	1.00	74496 (62353, 88498)	5844 (4095, 7548)	80340 (66637, 95700)	41.7	87692 (72140, 104921)
40 (Oct)	0.94	58772 (46858, 71445)	9756 (8154, 11513)	68528 (55481, 82193)	43.4	80801 (66198, 95957)
41	0.91	19839 (16224, 24063)	8541 (6224, 11019)	28380 (23845, 33087)	45.5	39124 (32599, 45945)
42	0.89	4215 (2663, 6052)	5484 (3008, 7991)	9700 (5764, 13876)	48.2	16598 (9618, 23865)
43	0.71	4959 (3377, 6916)	20347 (10446, 32037)	25306 (14193, 38093)	52.6	50902 (27368, 78212)
44 (Nov)	0.89	2384 (1444, 3620)	21086 (16398, 26794)	23470 (17992, 30378)	55.9	49996 (38591, 64024)
45	0.89	731 (319, 1179)	19330 (11420, 31040)	20061 (11925, 32080)	59.2	44378 (26285, 71036)
46	0.89	116 (60, 168)	5536 (3258, 8388)	5651 (3409, 8455)	61.8	12616 (7513, 19009)
47	0.83	77 (0, 178)	3897 (2913, 4989)	3975 (2935, 5102)	64.8	8876 (6597, 11378)
48 (Dec)	0.86	0	2075 (1209, 3115)	2075 (1209, 3115)	67.9	4685 (2730, 7034)
49	1.00	0	721 (455, 962)	721 (455, 962)	66.6	1628 (1027, 2172)
50	0.71	0	4181 (766, 8623)	4181 (766, 8623)	73.5	9441 (1730, 19471)
51	0.84	0	1868 (565, 3358)	1868 (565, 3358)	73.5	4218 (1276, 7582)
52	0.58	0	1168 (286, 2574)	1168 (286, 2574)	77	2637 (646, 5812)

Table B2. (continued)

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
1 (Jan)	0.84	0	665 (254, 1085)	665 (254, 1085)	81.2	1502 (574, 2450)
2	0.93	0	220 (22, 509)	220 (22, 509)	85.4	497 (50, 1149)
3	0.91	0	89 (0, 272)	89 (0, 272)	95	201 (0, 614)
4	0.90	0	291 (0, 895)	291 (0, 895)	77.5	657 (0, 2021)
5 (Feb)	0.91	0	58 (0, 178)	58 (0, 178)	125	131 (0, 402)
6	1.00	0	58 (0, 179)	58 (0, 179)	135	131 (0, 404)
7	0.97	0	141 (19, 336)	141 (19, 336)	103	318 (43, 759)
8	1.00	0	21 (0, 64)	21 (0, 64)	110	47 (0, 145)
9 (Mar)	0.99	0	0	0	-	0
10	0.90	0	126 (30, 254)	126 (30, 254)	126.2	285 (68, 574)
11	0.70	0	35 (0, 107)	35 (0, 107)	110	79 (0, 242)
12	0.47	0	53 (0, 161)	53 (0, 161)	101	120 (0, 364)
13	0.96	0	0	0	-	0
14 (Apr)	0.49	0	0	0	-	0
15	0.80	0	78 (0, 185)	78 (0, 185)	145.5	176 (0, 418)
16	0.61	0	0	0	-	0
17	1.00	0	109 (21, 215)	109 (21, 215)	154.8	246 (47, 485)
18 (May)	1.00	0	0	0	-	0
19	1.00	0	0	0	-	0
20	1.00	0	0	0	-	0
21	1.00	0	22 (0, 69)	22 (0, 69)	147	50 (0, 156)
22 (Jun)	0.66	0	0	0	-	0
23	0.80	0	0	0	-	0
24	0.80	0	0	0	-	0
25	0.80	0	0	0	-	0
26	0.80	0	0	0	-	0
BY 2021 total		322,366	113,343	435,709		578,293
95% CI		(299514, 346528)	(96830, 131299)	(405014, 467365)		(530416, 627947)

Table B3. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for spring Chinook Salmon passing RBDD (RK 391) for the period 10/16/2020 through 10/15/2021 (brood year 2020). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents with mark and genetic corrections. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of a fry to pre-smolt/smolt survival rate (59% or 1.7:1; Hallock undated).

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage	Total Passage	Mean FL (mm)	Fry-equivalent JPI
42	1.00	0	0	0	-	0
43	1.00	0	0	0	-	0
44 (Nov)	0.97	0	0	0	-	0
45	0.97	0	0	0	-	0
46	1.00	0	0	0	-	0
47	0.97	4502	0	4502	35	4502
48 (Dec)	0.71	9168	0	9168	35.4	9168
49	1.00	7333	161	7494	38	7606
50	0.91	4426	256	4681	38.9	4860
51	1.00	4354	138	4492	40.1	4588
52	0.78	2049	1044	3093	45.2	3818
1 (Jan)	0.96	2203	1526	3728	46.4	4789
2	0.91	316	765	1081	51	1613
3	1.00	0	1992	1992	52.5	3376
4	0.93	0	4836	4836	53.9	8197
5 (Feb)	0.79	0	12481	12481	55.9	21154
6	0.94	0	2741	2741	56	4646
7	0.90	0	1043	1043	59.1	1768
8	0.94	0	233	233	61.3	395
9 (Mar)	1.00	0	581	581	67	985
10	1.00	0	108	108	67.8	183
11	0.74	0	53623	53623	74.5	90886
12	0.51	0	0	0	-	0
13	0.80	0	0	0	-	0
14 (Apr)	0.40	0	0	0	-	0
15	0.39	0	9427	9427	83.8	15978

Table B3. (continued)

Week	Trap Effort	Fry Passage	Pre-smolt/smolt Passage	Total Passage	Mean FL (mm)	Fry-equivalent JPI
16	0.80	0	2294	2294	88.7	3888
17	0.87	0	6551	6551	93.1	11103
18 (May)	0.81	0	3425	3425	96.3	5805
19	0.79	0	3176	3176	101.3	5383
20	0.77	0	1169	1169	105.5	1981
21	0.86	0	427	427	109.8	724
22 (Jun)	0.83	0	31	31	112	53
23	0.89	0	30	30	118	51
24	0.74	0	0	0	-	0
25	0.77	0	0	0	-	0
26	0.80	0	0	0	-	0
27 (Jul)	0.54	0	0	0	-	0
28	0.80	0	0	0	-	0
29	0.80	0	0	0	-	0
30	0.80	0	0	0	-	0
31 (Aug)	0.80	0	0	0	-	0
32	0.83	0	0	0	-	0
33	0.89	0	0	0	-	0
34	0.86	0	0	0	-	0
35 (Sep)	0.86	0	0	0	-	0
36	1.00	0	0	0	-	0
37	1.00	0	0	0	-	0
38	1.00	0	0	0	-	0
39	1.00	0	0	0	-	0
40 (Oct)	0.94	0	0	0	-	0
41	0.91	0	0	0	-	0
BY 2020 total		34,351	108,058	142,407		217,500
95% CI		(28560, 40802)	(31325, 233027)	(60695, 268759)		(85340, 428997)

Table B4. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for spring Chinook Salmon passing RBDD (RK 391) for the period 10/16/2021 through 10/15/2022 (brood year 2021). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5 m-and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents with mark and genetic corrections. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of the fry to pre-smolt/smolt survival rate (59% or 1.7:1; Hallock undated).

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage	Total Passage	Mean FL (mm)	Fry-equivalent JPI
42	0.89	0	0	0	-	0
43	0.71	0	0	0	-	0
44 (Nov)	0.89	0	0	0	-	0
45	0.89	4226	0	4226	32.4	4226
46	0.89	4377	0	4377	33.1	4377
47	0.83	8013	0	8013	33.2	8013
48 (Dec)	0.86	18289	0	18289	33.9	18289
49	1.00	5993	0	5993	36.2	5993
50	0.71	13567	134	13701	37.7	13794
51	0.84	9365	405	9770	40.4	10051
52	0.58	2820	605	3425	42.8	3845
1 (Jan)	0.84	964	912	1876	45.6	2510
2	0.93	1213	1689	2902	47.3	4076
3	0.91	0	89	89	47	151
4	0.90	0	68	68	63	115
5 (Feb)	0.91	0	21	21	53	36
6	1.00	0	0	0	-	0
7	0.97	0	45	45	61	76
8	1.00	0	89	89	62.8	151
9 (Mar)	0.99	0	96	96	64	163
10	0.90	0	210	210	69.4	356
11	0.70	0	0	0	-	0
12	0.47	0	7083	7083	74.1	12005
13	0.96	0	0	0	-	0
14 (Apr)	0.49	0	0	0	-	0
15	0.80	0	0	0	-	0

Table B4. (continued)

Week	Trap Effort	Fry Passage	Pre-smolt/smolt Passage	Total Passage	Mean FL (mm)	Fry-equivalent JPI
16	0.61	0	21309	21309	90.8	36117
17	1.00	0	5828	5828	93.2	9878
18 (May)	1.00	0	1923	1923	96.7	3259
19	1.00	0	1913	1913	102.6	3242
20	1.00	0	244	244	104.8	414
21	1.00	0	92	92	107	156
22 (Jun)	0.66	0	0	0	-	0
23	0.80	0	72	72	122.3	122
24	0.80	0	0	0	-	0
25	0.80	0	0	0	-	0
26	0.80	0	0	0	-	0
27 (Jul)	0.97	0	0	0	-	0
28	0.91	0	0	0	-	0
29	0.91	0	0	0	-	0
30	0.91	0	0	0	-	0
31 (Aug)	0.91	0	0	0	-	0
32	0.77	0	0	0	-	0
33	0.89	0	0	0	-	0
34	0.91	0	0	0	-	0
35 (Sep)	0.91	0	0	0	-	0
36	0.91	0	0	0	-	0
37	0.91	0	0	0	-	0
38	0.89	0	0	0	-	0
39	0.91	0	0	0	-	0
40 (Oct)	0.94	0	0	0	-	0
41	0.91	0	0	0	-	0
BY 2021 total		68,827	42,827	111,654		141,415
95% CI		(52427, 89644)	(9066, 94646)	(53450, 182303)	-	(65292, 238835)

Table B5. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for fall Chinook Salmon passing RBDD (RK 391) for the period 12/1/2020 through 11/30/2021 (brood year 2020). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents with mark corrections. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of the fry to pre-smolt/smolt survival rate (59% or 1.7:1; Hallock undated).

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage	Total Passage	Mean FL (mm)	Fry-equivalent JPI
48 (Dec)	0.71	642	0	642	31.8	642
49	1.00	10347	0	10347	32.9	10347
50	0.91	15605	0	15605	33.7	15605
51	1.00	53588	0	53588	34.6	53588
52	0.78	193952	0	193952	35.9	193952
1 (Jan)	0.96	910885	0	910885	36.8	910885
2	0.91	137639	0	137639	36.4	137639
3	1.00	245601	42	245643	36.8	245672
4	0.93	257422	34632	292054	38	316120
5 (Feb)	0.79	638563	45558	684121	38.8	715780
6	0.94	178625	42099	220724	38.5	249979
7	0.90	931480	85602	1017082	38.2	1076568
8	0.94	65970	1093	67063	38.2	67823
9 (Mar)	1.00	46972	1215	48187	39.2	49031
10	1.00	13823	1020	14843	39.7	15552
11	0.74	25995	0	25995	49.1	25995
12	0.51	27684	0	27684	59.2	27684
13	0.80	1920	0	1920	61.5	1920
14 (Apr)	0.40	1894	5299	7193	61	10875
15	0.39	12646	0	12646	69.6	12646
16	0.80	175	47592	47767	69.7	80839
17	0.87	8831	129577	138408	70	228453
18 (May)	0.81	3217	168891	172108	72.5	289473
19	0.79	1928	199431	201359	72.6	339947
20	0.77	0	115108	115108	72.4	195098
21	0.86	0	101663	101663	72.5	172310

Table B5. (continued)

Week	Trap Effort	Fry Passage	Pre-smolt/smolt Passage	Total Passage	Mean FL (mm)	Fry-equivalent JPI
22 (Jun)	0.83	0	29455	29455	71	49924
23	0.89	0	14631	14631	72.2	24798
24	0.74	0	11610	11610	75.8	19678
25	0.77	0	29347	29347	79	49741
26	0.80	0	15371	15371	79.3	26053
27 (Jul)	0.54	0	6583	6583	83.1	11158
28	0.80	0	3792	3792	84.8	6427
29	0.80	0	4317	4317	87.6	7317
30	0.80	0	2998	2998	93.7	5081
31 (Aug)	0.80	0	780	780	92.9	1322
32	0.83	0	374	374	99.6	634
33	0.89	0	393	393	104.2	666
34	0.86	0	228	228	124.5	386
35 (Sep)	0.86	0	147	147	113.6	249
36	1.00	0	229	229	116.8	388
37	1.00	0	141	141	118.2	239
38	1.00	0	337	337	127.1	571
39	1.00	0	333	333	117.4	564
40 (Oct)	0.94	0	244	244	128.1	414
41	0.91	0	244	244	133.2	414
42	0.89	0	142	142	152.6	241
43	0.71	0	820	820	140.5	1390
44 (Nov)	0.89	0	1131	1131	149.4	1917
45	0.89	0	283	283	158.2	480
46	0.89	0	94	94	152.2	159
47	0.83	0	24	24	158	41
BY 2020 total		3,785,404	1,102,870	4,888,274		5,654,675
95% CI		(2479097, 5355805)	(531436, 1779706)	(2296007, 8153013)		(2881919, 9066203)

Table B6. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for fall Chinook Salmon passing RBDD (RK 391) for the period 12/1/2021 through 11/30/2022 (brood year 2021). Trap sampling effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents with mark corrections. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of the fry to pre-smolt/smolt survival rate (59% or 1.7:1; Hallock undated).

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage	Total Passage	Mean FL (mm)	Fry-equivalent JPI
48 (Dec)	0.86	5950	0	5950	32	5950
49	1.00	15739	0	15739	32.6	15739
50	0.71	71221	0	71221	33.5	71221
51	0.84	164539	0	164539	34.6	164539
52	0.58	189905	0	189905	35.6	189905
1 (Jan)	0.84	567801	0	567801	36.3	567801
2	0.93	648905	0	648905	36.8	648905
3	0.91	559573	0	559573	37.1	559573
4	0.90	401440	0	401440	36.9	401440
5 (Feb)	0.91	257783	9328	267111	37.1	273593
6	1.00	242796	17016	259812	37.4	271637
7	0.97	106196	5	106201	37.4	106204
8	1.00	27270	293	27563	38.4	27767
9 (Mar)	0.99	8334	594	8928	39.1	9341
10	0.90	3325	0	3325	40.6	3325
11	0.70	930	0	930	53.9	930
12	0.47	5973	18717	24690	62	37697
13	0.96	1548	0	1548	64.2	1548
14 (Apr)	0.49	168	63994	64162	67.1	108632
15	0.80	101	40444	40545	68.3	68650
16	0.61	0	107843	107843	70.9	182785
17	1.00	21	74200	74221	72.7	125784
18 (May)	1.00	0	66925	66925	75.2	113432
19	1.00	0	83698	83698	76.4	141861
20	1.00	0	34121	34121	76.3	57832
21	1.00	0	17884	17884	76.5	30312

Table B6. (continued)

Week	Trap Effort	Fry Passage	Pre-smolt/smolt Passage	Total Passage	Mean FL (mm)	Fry-equivalent JPI
22 (Jun)	0.66	0	8679	8679	78	14710
23	0.80	0	13687	13687	76.9	23198
24	0.80	0	6940	6940	77	11763
25	0.80	0	5388	5388	76.4	9132
26	0.80	0	1096	1096	82.8	1858
27 (Jul)	0.97	0	437	437	83.2	741
28	0.91	0	732	732	85.2	1241
29	0.91	0	406	406	91.3	688
30	0.91	0	185	185	92.4	314
31 (Aug)	0.91	0	117	117	94.4	198
32	0.77	0	185	185	108.3	314
33	0.89	0	190	190	100.1	322
34	0.91	0	95	95	120.5	161
35 (Sep)	0.91	0	23	23	115	39
36	0.91	0	24	24	99	41
37	0.91	0	22	22	108	37
38	0.89	0	903	903	128.6	1531
39	0.91	0	89	89	123	151
40 (Oct)	0.94	0	0	0	-	0
41	0.91	0	22	22	131	37
42	0.91	0	22	22	134	37
43	0.91	0	22	22	151	37
44 (Nov)	0.91	0	45	45	157.5	76
45	0.89	0	24	24	167	41
46	0.91	0	65	65	152.3	110
47	0.57	0	0	0	-	0
BY 2021 total		3,279,518	574,460	3,853,978		4,253,180
95% CI		(2904576, 3698515)	(263413, 946329)	(1921864, 6173902)		(2294455, 6569567)

Table B7. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for late-fall Chinook Salmon passing RBDD (RK 391) for the period 4/1/2020* through 3/30/2021 (brood year 2020). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of the fry to pre-smolt/smolt survival rate (59% or 1.7:1; Hallock undated). **Shaded region not sampled due to COVID-19 pandemic from 3/25/2020 to 6/30/2020.*

Week*	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
14 (Apr)	-	-	-	-	-	-
15	-	-	-	-	-	-
16	-	-	-	-	-	-
17	-	-	-	-	-	-
18 (May)	-	-	-	-	-	-
19	-	-	-	-	-	-
20	-	-	-	-	-	-
21	-	-	-	-	-	-
22 (Jun)	-	-	-	-	-	-
23	-	-	-	-	-	-
24	-	-	-	-	-	-
25	-	-	-	-	-	-
26	-	-	-	-	-	-
27 (Jul)	1.00	145 (32, 290)	553 (374, 734)	699 (534, 895)	55.5	1082 (820, 1386)
28	1.00	191 (67, 336)	1215 (728, 1719)	1406 (868, 1946)	58.1	2250 (1389, 3130)
29	1.00	0	509 (187, 903)	509 (187, 903)	63.5	863 (317, 1531)
30	0.86	0	726 (384, 1128)	726 (384, 1128)	66.1	1231 (651, 1912)
31 (Aug)	1.00	0	1177 (738, 1758)	1177 (738, 1758)	67.6	1995 (1251, 2980)
32	1.00	0	815 (458, 1182)	815 (458, 1182)	68.5	1381 (776, 2003)
33	0.97	0	595 (234, 969)	595 (234, 969)	73.4	1008 (397, 1642)
34	1.00	0	206 (63, 402)	206 (63, 402)	70.2	349 (107, 681)
35 (Sep)	1.00	0	148 (56, 257)	148 (56, 257)	78	251 (95, 436)
36	1.00	0	149 (29, 320)	149 (29, 320)	71.8	253 (49, 542)
37	1.00	0	112 (26, 225)	112 (26, 225)	83.2	190 (44, 381)
38	1.00	0	332 (92, 608)	332 (92, 608)	79.3	563 (156, 1031)
39	1.00	0	953 (328, 1670)	953 (328, 1670)	70.9	1615 (556, 2831)

Table B7. (continued)

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
40 (Oct)	1.00	0	1038 (653, 1497)	1038 (653, 1497)	71	1759 (1107, 2537)
41	0.97	0	1543 (980, 2133)	1543 (980, 2133)	77.1	2615 (1661, 3615)
42	1.00	0	734 (475, 1051)	734 (475, 1051)	78.2	1244 (805, 1781)
43	1.00	0	2231 (1758, 2607)	2231 (1758, 2607)	82.6	3781 (2980, 4419)
44 (Nov)	0.97	0	1748 (1010, 2587)	1748 (1010, 2587)	93.8	2963 (1712, 4385)
45	0.97	0	462 (252, 667)	462 (252, 667)	107.1	783 (427, 1131)
46	1.00	0	593 (292, 946)	593 (292, 946)	107.3	1005 (495, 1603)
47	0.97	0	435 (143, 763)	435 (143, 763)	120.5	737 (242, 1293)
48 (Dec)	0.71	0	346 (224, 484)	346 (224, 484)	108.5	586 (380, 820)
49	1.00	0	265 (89, 509)	265 (89, 509)	115.3	449 (151, 863)
50	0.91	0	89 (24, 142)	89 (24, 142)	110.5	151 (41, 241)
51	1.00	0	156 (43, 285)	156 (43, 285)	116.7	264 (73, 483)
52	0.78	0	445 (27, 972)	445 (27, 972)	116	754 (46, 1647)
1 (Jan)	0.96	0	766 (0, 2366)	766 (0, 2366)	155.2	1298 (0, 4010)
2	0.91	0	469 (57, 964)	469 (57, 964)	150.7	795 (97, 1634)
3	1.00	0	0	0	-	0
4	0.93	0	0	0	-	0
5 (Feb)	0.79	0	427 (0, 1160)	427 (0, 1160)	136	724 (0, 1966)
6	0.94	0	0	0	-	0
7	0.90	0	0	0	-	0
8	0.94	0	0	0	-	0
9 (Mar)	1.00	0	0	0	-	0
10	1.00	0	0	0	-	0
11	0.74	0	0	0	-	0
12	0.51	0	0	0	-	0
13	0.80	0	0	0	-	0
BY 2020 total		336*	19,237*	19,574*		32,939*
95% CI		(149, 537)	(16822, 21820)	(17177, 22169)		(28876, 37325)

Table B8. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for late-fall Chinook Salmon passing RBDD (RK 391) for the period 4/1/2021 through 3/30/2022 (brood year 2021). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of the fry to pre-smolt/smolt survival rate (59% or 1.7:1; Hallock undated).

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
14 (Apr)	0.40	387 (0, 1001)	0	387 (0, 1001)	34.8	387 (0, 1001)
15	0.39	0	0	0	-	0
16	0.80	163 (0, 407)	0	163 (0, 407)	35	163 (0, 407)
17	0.87	420 (157, 767)	0	420 (157, 767)	36.3	420 (157, 767)
18 (May)	0.81	437 (172, 725)	0	437 (172, 725)	37.6	437 (172, 725)
19	0.79	588 (162, 1072)	0	588 (162, 1072)	37.5	588 (162, 1072)
20	0.77	180 (35, 382)	0	180 (35, 382)	39	180 (35, 382)
21	0.86	34 (0, 106)	99 (0, 238)	133 (31, 265)	43.7	202 (31, 429)
22 (Jun)	0.83	117 (28, 235)	53 (0, 164)	171 (57, 294)	41	207 (59, 389)
23	0.89	0	89 (28, 169)	89 (28, 169)	48	151 (47, 286)
24	0.74	0	98 (0, 245)	98 (0, 245)	54	166 (0, 415)
25	0.77	0	316 (63, 652)	316 (63, 652)	54.9	536 (107, 1105)
26	0.80	33 (0, 101)	104 (31, 183)	137 (63, 212)	51	209 (86, 330)
27 (Jul)	0.54	193 (0, 404)	249 (48, 445)	442 (48, 847)	50.2	615 (81, 1153)
28	0.80	241 (98, 429)	100 (30, 185)	342 (182, 507)	45.3	410 (221, 591)
29	0.80	0	292 (109, 500)	292 (109, 500)	64.2	495 (185, 847)
30	0.80	0	142 (40, 231)	142 (40, 231)	63	241 (68, 392)
31 (Aug)	0.80	0	0	0	-	0
32	0.83	0	0	0	-	0
33	0.89	0	103 (31, 193)	103 (31, 193)	78.3	175 (53, 327)
34	0.86	0	0	0	-	0
35 (Sep)	0.86	0	115 (26, 230)	115 (26, 230)	70	195 (44, 390)
36	1.00	0	222 (58, 384)	222 (58, 384)	73	376 (98, 651)
37	1.00	0	312 (137, 479)	312 (137, 479)	72.7	529 (232, 812)
38	1.00	0	537 (327, 804)	537 (327, 804)	72.9	910 (554, 1363)
39	1.00	0	1858 (915, 2984)	1858 (915, 2984)	69.5	3149 (1551, 5058)

Table B8. (continued)

Week	Trap Effort	Fry Passage (95% CI)	Pre-smolt/smolt Passage (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
40 (Oct)	0.94	0	1820 (1508, 2164)	1820 (1508, 2164)	71.5	3085 (2556, 3668)
41	0.91	0	1597 (1055, 2129)	1597 (1055, 2129)	77.3	2707 (1788, 3608)
42	0.89	0	1000 (571, 1512)	1000 (571, 1512)	80.5	1695 (968, 2563)
43	0.71	0	3581 (1023, 7128)	3581 (1023, 7128)	91.1	6069 (1734, 12081)
44 (Nov)	0.89	0	5411 (2566, 9669)	5411 (2566, 9669)	107.5	9171 (4349, 16388)
45	0.89	0	3841 (2467, 5354)	3841 (2467, 5354)	109.3	6510 (4181, 9075)
46	0.89	0	1696 (1018, 2464)	1696 (1018, 2464)	117.5	2875 (1725, 4176)
47	0.83	0	1466 (1190, 1776)	1466 (1190, 1776)	115.8	2485 (2017, 3010)
48 (Dec)	0.86	0	704 (471, 943)	704 (471, 943)	118.9	1193 (798, 1598)
49	1.00	0	281 (100, 499)	281 (100, 499)	115.6	476 (169, 846)
50	0.71	0	8862 (1163, 18038)	8862 (1163, 18038)	137	15020 (1971, 30573)
51	0.84	0	1202 (154, 2949)	1202 (154, 2949)	123.4	2037 (261, 4998)
52	0.58	0	405 (50, 914)	405 (50, 914)	119.4	686 (85, 1549)
1 (Jan)	0.84	0	347 (0, 878)	347 (0, 878)	129.5	588 (0, 1488)
2	0.93	0	340 (20, 825)	340 (20, 825)	137	576 (34, 1398)
3	0.91	0	89 (0, 274)	89 (0, 274)	136	151 (0, 464)
4	0.90	0	0	0	-	0
5 (Feb)	0.91	0	95 (0, 290)	95 (0, 290)	149	161 (0, 492)
6	1.00	0	0	0	-	0
7	0.97	0	0	0	-	0
8	1.00	0	0	0	-	0
9 (Mar)	0.99	0	0	0	-	0
10	0.90	0	0	0	-	0
11	0.70	0	0	0	-	0
12	0.47	0	0	0	-	0
13	0.96	0	0	0	-	0
BY 2021 total		2,793	37,426	40,221		66,226
95% CI		(1930, 3727)	(27912, 48110)	(30669, 50941)		(50135, 84425)

Table B9. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI) and mean fork length (Med FL) for *O. mykiss* passing Red Bluff Diversion Dam (RK 391) for the period 1/1/2020 through 12/31/2020* (brood year 2020). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include total estimated passage (fry, sub-yearling and yearlings combined). * Shaded region not sampled due to COVID-19 pandemic from 3/25/2020 to 6/30/2020.

Week*	Trap Effort	Total Passage (95% CI)	Mean FL (mm)	Week (cont.)	Trap Effort (cont.)	Total Passage (95% CI) (cont.)	Mean FL (mm) (cont.)
1 (Jan)	1.00	22 (0, 68)	66	27 (Jul)	1.00	1799 (1242, 2390)	71.3
2	0.79	0	-	28	1.00	2291 (1755, 2789)	69.7
3	0.50	120 (0, 370)	30.3	29	1.00	2008 (1266, 2863)	67
4	0.36	0	-	30	0.86	2600 (1869, 3481)	65.2
5 (Feb)	0.50	0	-	31 (Aug)	1.00	3358 (2301, 4337)	67.5
6	0.55	34 (0, 107)	83	32	1.00	5339 (4202, 6580)	65.5
7	0.73	417 (161, 668)	27.1	33	0.97	2848 (2065, 3706)	63.9
8	1.00	119 (59, 185)	51.3	34	1.00	1700 (1201, 2231)	63.8
9 (Mar)	1.00	42 (0, 91)	49.5	35 (Sep)	1.00	1918 (1548, 2268)	59.8
10	1.00	40 (0, 91)	57.5	36	1.00	1107 (678, 1720)	69.5
11	0.79	116 (33, 221)	23.8	37	1.00	754 (557, 914)	68.5
12	0.57	218 (72, 308)	37.8	38	1.00	614 (338, 897)	61.9
13	-	-	-	39	1.00	524 (286, 782)	74.4
14 (Apr)	-	-	-	40 (Oct)	1.00	264 (103, 433)	76.9
15	-	-	-	41	0.97	284 (161, 400)	77
16	-	-	-	42	1.00	198 (0, 499)	82.1
17	-	-	-	43	1.00	255 (73, 548)	82.4
18 (May)	-	-	-	44 (Nov)	0.97	160 (49, 315)	80.7
19	-	-	-	45	0.97	83 (25, 156)	68.3
20	-	-	-	46	1.00	25 (0, 77)	84
21	-	-	-	47	0.97	56 (0, 169)	100
22 (Jun)	-	-	-	48 (Dec)	0.71	63 (0, 194)	112.5
23	-	-	-	49	1.00	45 (0, 96)	105.5
24	-	-	-	50	0.91	72 (0, 173)	97.3
25	-	-	-	51	1.00	0	-
26	-	-	-	52	0.78	60 (0, 182)	92
				BY 2020 total		29,553*	
				95% CI		(26918, 31963)	

Table B10. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI) and mean fork length (Med FL) for *O. mykiss* passing Red Bluff Diversion Dam (RK 391) for the period 1/1/2021 through 12/31/2021 (brood year 2021). Full sampling effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5 m and (1) 2.4 m diameter rotary-screw traps sampling 7 days per week. Results include total estimated passage (fry, sub-yearling and yearlings combined).

Week	Trap Effort	Total Passage (95% CI)	Mean FL (mm)	Week (cont.)	Trap Effort (cont.)	Total Passage (95% CI) (cont.)	Mean FL (mm) (cont.)
1 (Jan)	0.96	104 (0, 325)	78	27 (Jul)	0.54	1415 (1015, 1801)	70.2
2	0.91	29 (0, 90)	200	28	0.80	890 (601, 1214)	63.9
3	1.00	41 (0, 125)	91.5	29	0.80	654 (345, 963)	66.2
4	0.93	28 (0, 88)	85	30	0.80	866 (590, 1126)	75.2
5 (Feb)	0.79	120 (0, 379)	88	31 (Aug)	0.80	1079 (697, 1511)	69.3
6	0.94	55 (0, 126)	131	32	0.83	785 (412, 1136)	67.1
7	0.90	98 (0, 234)	28.3	33	0.89	466 (173, 789)	62.5
8	0.94	369 (101, 669)	26.4	34	0.86	556 (251, 967)	66.4
9 (Mar)	1.00	121 (39, 210)	56.8	35 (Sep)	0.86	676 (405, 960)	76.6
10	1.00	154 (41, 299)	23.7	36	1.00	388 (282, 495)	76.2
11	0.74	205 (36, 449)	67	37	1.00	390 (224, 537)	76.8
12	0.51	55 (0, 167)	26	38	1.00	345 (166, 549)	86.1
13	0.80	65 (0, 149)	64.5	39	1.00	701 (333, 1112)	72.9
14 (Apr)	0.40	175 (0, 350)	23.5	40 (Oct)	0.94	291 (107, 516)	65.5
15	0.39	748 (0, 1403)	47.5	41	0.91	186 (58, 328)	73.2
16	0.80	705 (180, 1261)	55.7	42	0.89	149 (55, 266)	94.2
17	0.87	2373 (1764, 3130)	57.2	43	0.71	129 (0, 392)	106.5
18 (May)	0.81	3558 (2717, 4450)	59	44 (Nov)	0.89	107 (25, 215)	84.2
19	0.79	7975 (6011, 10115)	61.3	45	0.89	90 (0, 287)	69
20	0.77	6486 (4861, 8195)	63.8	46	0.89	46 (0, 102)	136
21	0.86	4813 (3885, 5777)	66.8	47	0.83	25 (0, 75)	96
22 (Jun)	0.83	4264 (3141, 5470)	65	48 (Dec)	0.86	48 (0, 101)	99
23	0.89	1653 (1244, 2070)	71.7	49	1.00	24 (0, 72)	86
24	0.74	1619 (1106, 2167)	65.8	50	0.71	123 (0, 392)	184
25	0.77	1708 (1171, 2226)	72.5	51	0.84	173 (38, 336)	115.5
26	0.80	1337 (998, 1714)	71.5	52	0.58	139 (0, 430)	116
				BY 2021 total		49,599	
				95% CI		(45823, 53338)	

Appendix C. Revised Brood year 2020 - 2023 *Unmarked* Fall and Spring Chinook Salmon

Weekly Passage Estimate Tables Based on 44-Trial Trap Efficiency GLMs

Appendix C: List of Tables

Table **Page**

Appendix C: List of Tables continued

Table **Page**

Table C1. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for fall Chinook Salmon passing RBDD (RK 391) for the period 12/1/2020 through 11/30/2021 (brood year 2020). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of the fry to pre-smolt/smolt survival rate (59% or 1.7:1; Hallock undated).

Week	Trap Effort	Fry (95% CI)	Pre-smolt/smolt (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
48 (Dec)	0.71	642 (0, 1971)	0	642 (0, 1971)	31.8	642 (0, 1971)
49	1.00	10347 (7776, 12539)	0	10347 (7776, 12539)	32.9	10347 (7776, 12539)
50	0.91	15605 (12524, 18829)	0	15605 (12524, 18829)	33.7	15605 (12524, 18829)
51	1.00	53588 (32480, 74128)	0	53588 (32480, 74128)	34.6	53588 (32480, 74128)
52	0.78	193952 (105414, 298670)	0	193952 (105414, 298670)	35.9	193952 (105414, 298670)
1 (Jan)	0.96	910885 (54711, 2210200)	0	910885 (54711, 2210200)	36.8	910885 (54711, 2210200)
2	0.91	137639 (102806, 169600)	0	137639 (102806, 169600)	36.4	137639 (102806, 169600)
3	1.00	245601 (204966, 287750)	42 (0, 128)	245643 (205058, 287770)	36.8	245672 (205102, 287780)
4	0.93	257422 (120310, 452309)	34632 (4260, 90518)	292055 (129171, 540052)	38	316120 (134093, 600627)
5 (Feb)	0.79	638563 (251522, 1053670)	45558 (12407, 88884)	684121 (268580, 1135643)	38.8	715780 (278791, 1190771)
6	0.94	178625 (99531, 284656)	42165 (6739, 88976)	220790 (110132, 373820)	38.5	250091 (116668, 433951)
7	0.90	931480 (310504, 1795025)	85602 (9782, 183389)	1017082 (375560, 1864289)	38.2	1076568 (414756, 1917750)
8	0.94	65970 (55568, 78181)	1093 (868, 1319)	67063 (56499, 79456)	38.2	67823 (57148, 80344)
9 (Mar)	1.00	46972 (32443, 67859)	1215 (994, 1453)	48187 (33496, 69169)	39.2	49031 (34251, 70110)
10	1.00	13823 (10323, 17256)	1020 (722, 1430)	14843 (11211, 18544)	39.7	15552 (11818, 19445)
11	0.74	25995 (12113, 44074)	49977 (16278, 103568)	75972 (34405, 129435)	49.1	110702 (47318, 201817)
12	0.51	27684 (6878, 58681)	107393 (38963, 177026)	135077 (46066, 228745)	59.2	209706 (73165, 350536)
13	0.80	1920 (260, 4773)	28429 (6235, 57864)	30349 (6603, 62355)	61.5	50105 (10908, 102470)
14 (Apr)	0.40	1894 (1275, 2330)	9007 (7457, 10401)	10901 (9517, 12427)	61	17160 (14754, 19637)
15	0.39	12646 (0, 37308)	353003 (93676, 672705)	365650 (93676, 672825)	69.6	610956 (158772, 1140179)
16	0.80	175 (31, 334)	132411 (93529, 181180)	132587 (93656, 181253)	69.7	224600 (158617, 307116)
17	0.87	8831 (290, 26395)	170356 (113511, 226947)	179188 (117505, 242939)	70	297570 (195779, 399031)
18 (May)	0.81	3217 (158, 9202)	185670 (145922, 230574)	188887 (149970, 232935)	72.5	317912 (251913, 393060)
19	0.79	1928 (0, 5944)	201273 (147828, 270810)	203200 (150294, 272081)	72.6	343069 (252490, 460604)
20	0.77	0	115225 (92826, 139381)	115225 (92826, 139381)	72.4	195297 (157332, 236238)
21	0.86	0	101861 (81659, 122467)	101861 (81659, 122467)	72.5	172646 (138406, 207570)

Table C1. (continued)

Week	Trap Effort	Fry (95% CI)	Pre-smolt/smolt (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
22 (Jun)	0.83	0	29542 (21180, 38005)	29542 (21180, 38005)	71	50071 (35898, 64415)
23	0.89	0	14631 (12516, 16759)	14631 (12516, 16759)	72.2	24798 (21214, 28405)
24	0.74	0	11610 (9788, 13771)	11610 (9788, 13771)	75.8	19678 (16590, 23341)
25	0.77	0	29347 (19840, 41440)	29347 (19840, 41440)	79	49741 (33626, 70238)
26	0.80	0	15371 (9787, 20863)	15371 (9787, 20863)	79.3	26053 (16588, 35361)
27 (Jul)	0.54	0	6583 (5225, 8091)	6583 (5225, 8091)	83.1	11158 (8855, 13714)
28	0.80	0	3792 (2900, 4836)	3792 (2900, 4836)	84.8	6427 (4915, 8197)
29	0.80	0	4317 (3515, 5160)	4317 (3515, 5160)	87.6	7317 (5958, 8746)
30	0.80	0	2998 (2185, 3924)	2998 (2185, 3924)	93.7	5081 (3703, 6651)
31 (Aug)	0.80	0	780 (470, 1119)	780 (470, 1119)	92.9	1322 (797, 1897)
32	0.83	0	374 (265, 500)	374 (265, 500)	99.6	634 (449, 847)
33	0.89	0	393 (155, 664)	393 (155, 664)	104.2	666 (263, 1125)
34	0.86	0	228 (58, 492)	228 (58, 492)	124.5	386 (98, 834)
35 (Sep)	0.86	0	147 (52, 268)	147 (52, 268)	113.6	249 (88, 454)
36	1.00	0	229 (90, 385)	229 (90, 385)	116.8	388 (153, 653)
37	1.00	0	141 (52, 250)	141 (52, 250)	118.2	239 (88, 424)
38	1.00	0	337 (88, 608)	337 (88, 608)	127.1	571 (149, 1031)
39	1.00	0	333 (116, 590)	333 (116, 590)	117.4	564 (197, 1000)
40 (Oct)	0.94	0	244 (116, 375)	244 (116, 375)	128.1	414 (197, 636)
41	0.91	0	244 (99, 399)	244 (99, 399)	133.2	414 (168, 676)
42	0.89	0	142 (51, 251)	142 (51, 251)	152.6	241 (86, 425)
43	0.71	0	820 (195, 1485)	820 (195, 1485)	140.5	1390 (331, 2517)
44 (Nov)	0.89	0	1131 (531, 1819)	1131 (531, 1819)	149.4	1917 (900, 3083)
45	0.89	0	283 (105, 486)	283 (105, 486)	158.2	480 (178, 824)
46	0.89	0	94 (20, 197)	94 (20, 197)	152.2	159 (34, 334)
47	0.83	0	24 (0, 73)	24 (0, 73)	158	41 (0, 124)
BY 2020 total		3,785,404	1,790,067	5,575,474		6,819,417
95% CI		(2479097, 5355805)	(1464543, 2141401)	(4221516, 7170566)		(5364396, 8487470)

Table C2. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for fall Chinook Salmon passing RBDD (RK 391) for the period 12/1/2021 through 11/30/2022 (brood year 2021). Trap sampling effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of the fry to pre-smolt/smolt survival rate (59% or 1.7:1; Hallock undated).

Week	Trap Effort	Fry (95% CI)	Pre-smolt/smolt (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
48 (Dec)	0.86	5950 (0, 12399)	0	5950 (0, 12399)	32	5950 (0, 12399)
49	1.00	15739 (12213, 20017)	0	15739 (12213, 20017)	32.6	15739 (12213, 20017)
50	0.71	71221 (10474, 189261)	0	71221 (10474, 189261)	33.5	71221 (10474, 189261)
51	0.84	164539 (81701, 260489)	0	164539 (81701, 260489)	34.6	164539 (81701, 260489)
52	0.58	189905 (126637, 257237)	0	189905 (126637, 257237)	35.6	189905 (126637, 257237)
1 (Jan)	0.84	567801 (364062, 843492)	0	567801 (364062, 843492)	36.3	567801 (364062, 843492)
2	0.93	648905 (436090, 903761)	0	648905 (436090, 903761)	36.8	648905 (436090, 903761)
3	0.91	559573 (436474, 704698)	0	559573 (436474, 704698)	37.1	559573 (436474, 704698)
4	0.90	401440 (359758, 445854)	0	401440 (359758, 445854)	36.9	401440 (359758, 445854)
5 (Feb)	0.91	257783 (228440, 285771)	9328 (20, 22161)	267111 (236233, 294933)	37.1	273593 (239556, 305193)
6	1.00	242796 (189039, 300575)	17016 (97, 40800)	259812 (207641, 312613)	37.4	271637 (214287, 327013)
7	0.97	106196 (70331, 145246)	62 (18, 119)	106259 (70395, 145329)	37.4	106301 (70442, 145387)
8	1.00	27270 (22662, 33441)	293 (131, 479)	27562 (22996, 33776)	38.4	27767 (23196, 33994)
9 (Mar)	0.99	8334 (4794, 13108)	594 (376, 904)	8929 (5301, 13994)	39.1	9341 (5646, 14584)
10	0.90	3325 (2467, 4493)	1101 (558, 1742)	4426 (3325, 5858)	40.6	5191 (3800, 6903)
11	0.70	930 (442, 1512)	23740 (185, 71605)	24670 (758, 72494)	53.9	41167 (911, 122192)
12	0.47	5973 (942, 15667)	98010 (63619, 155481)	103984 (67974, 159035)	62	172092 (112965, 266707)
13	0.96	1548 (234, 3995)	54320 (22768, 108527)	55868 (24289, 109221)	64.2	93616 (40081, 184793)
14 (Apr)	0.49	168 (0, 499)	247387 (125503, 457272)	247555 (125655, 457361)	67.1	419468 (212878, 775121)
15	0.80	101 (27, 184)	93016 (59127, 125142)	93117 (59198, 125292)	68.3	157755 (100285, 212256)
16	0.61	0	134378 (75970, 206544)	134378 (75970, 206544)	70.9	227759 (128763, 350075)
17	1.00	21 (0, 65)	85381 (57073, 122404)	85402 (57082, 122426)	72.7	144735 (96748, 207486)
18 (May)	1.00	0	71776 (58472, 85727)	71776 (58472, 85727)	75.2	121654 (99106, 145300)
19	1.00	0	85336 (73958, 97600)	85336 (73958, 97600)	76.4	144637 (125353, 165424)
20	1.00	0	34385 (27721, 40966)	34385 (27721, 40966)	76.3	58280 (46985, 69434)
21	1.00	0	17884 (14297, 22164)	17884 (14297, 22164)	76.5	30312 (24232, 37566)

Table C2. (continued)

Week	Trap Effort	Fry (95% CI)	Pre-smolt/smolt (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
22 (Jun)	0.66	0	8679 (7665, 9824)	8679 (7665, 9824)	78	14710 (12992, 16651)
23	0.80	0	13687 (9911, 17204)	13687 (9911, 17204)	76.9	23198 (16798, 29159)
24	0.80	0	6940 (4022, 10099)	6940 (4022, 10099)	77	11763 (6817, 17117)
25	0.80	0	5388 (4113, 6733)	5388 (4113, 6733)	76.4	9132 (6971, 11412)
26	0.80	0	1096 (794, 1422)	1096 (794, 1422)	82.8	1858 (1346, 2410)
27 (Jul)	0.97	0	437 (259, 697)	437 (259, 697)	83.2	741 (439, 1181)
28	0.91	0	732 (550, 910)	732 (550, 910)	85.2	1241 (932, 1542)
29	0.91	0	406 (73, 826)	406 (73, 826)	91.3	688 (124, 1400)
30	0.91	0	185 (93, 299)	185 (93, 299)	92.4	314 (158, 507)
31 (Aug)	0.91	0	117 (21, 233)	117 (21, 233)	94.4	198 (36, 395)
32	0.77	0	185 (26, 436)	185 (26, 436)	108.3	314 (44, 739)
33	0.89	0	190 (74, 312)	190 (74, 312)	100.1	322 (125, 529)
34	0.91	0	95 (43, 153)	95 (43, 153)	120.5	161 (73, 259)
35 (Sep)	0.91	0	23 (0, 72)	23 (0, 72)	115	39 (0, 122)
36	0.91	0	24 (0, 73)	24 (0, 73)	99	41 (0, 124)
37	0.91	0	22 (0, 67)	22 (0, 67)	108	37 (0, 114)
38	0.89	0	903 (22, 2204)	903 (22, 2204)	128.6	1531 (37, 3736)
39	0.91	0	89 (18, 182)	89 (18, 182)	123	151 (30, 308)
40 (Oct)	0.94	0	0	0	-	0
41	0.91	0	22 (0, 67)	22 (0, 67)	131	37 (0, 114)
42	0.91	0	22 (0, 69)	22 (0, 69)	134	37 (0, 117)
43	0.91	0	22 (0, 69)	22 (0, 69)	151	37 (0, 117)
44 (Nov)	0.91	0	45 (0, 105)	45 (0, 105)	157.5	76 (0, 178)
45	0.89	0	24 (0, 73)	24 (0, 73)	167	41 (0, 124)
46	0.91	0	65 (20, 124)	65 (20, 124)	152.3	110 (34, 210)
47	0.57	0	0	0	-	0
BY 2021 total		3,279,518	1,013,405	4,292,925		4,997,155
95% CI		(2904576, 3698515)	(823701, 1247076)	(3860825, 4758122)		(4480947, 5561279)

Table C3. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for fall Chinook Salmon passing RBDD (RK 391) for the period 12/1/2022 through 11/30/2023 (brood year 2022). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of the fry to pre-smolt/smolt survival rate (59% or 1.7:1; Hallock undated).

Week	Trap Effort	Fry (95% CI)	Pre-smolt/smolt (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
48 (Dec)	0.80	0	0	0	-	0
49	0.59	3715 (1496, 6164)	0	3715 (1496, 6164)	33.9	3715 (1496, 6164)
50	0.81	16413 (13211, 20620)	0	16413 (13211, 20620)	34.4	16413 (13211, 20620)
51	0.89	11417 (9679, 13174)	0	11417 (9679, 13174)	35.4	11417 (9679, 13174)
52	0.45	725899 (58857, 1957054)	0	725899 (58857, 1957054)	36.1	725899 (58857, 1957054)
1 (Jan)	0.44	60178 (21808, 107938)	0	60178 (21808, 107938)	36	60178 (21808, 107938)
2	0.00	360032 (141901, 605349)	318 (0, 712)	360350 (142139, 605355)	-	360572 (142305, 605360)
3	0.43	659885 (218823, 1148519)	637 (0, 1424)	660523 (219285, 1149052)	36.8	660965 (219606, 1149382)
4	0.86	132306 (110634, 154981)	366 (39, 770)	132672 (111092, 155131)	37.7	132926 (111442, 155198)
5 (Feb)	0.83	624240 (154181, 1467898)	56 (0, 169)	624296 (154295, 1467898)	36.7	624335 (154374, 1467898)
6	1.00	152615 (87215, 230915)	324 (95, 586)	152939 (87686, 231022)	37.7	153164 (88007, 231212)
7	1.00	37522 (29744, 44309)	116 (22, 228)	37639 (29838, 44416)	37.7	37719 (29878, 44500)
8	1.00	20745 (17809, 23928)	173 (79, 267)	20918 (17938, 24143)	37.9	21038 (18031, 24275)
9 (Mar)	0.81	12965 (4632, 23528)	547 (60, 1288)	13512 (5325, 23861)	38.2	13892 (5870, 24128)
10	0.57	2812 (1612, 3788)	985 (325, 1591)	3796 (1925, 5325)	43.1	4481 (2173, 6413)
11	0.11	14041 (11580, 16897)	20697 (17069, 24906)	34739 (28649, 41803)	50.2	49121 (40511, 59111)
12	0.77	10169 (4739, 16487)	18540 (13582, 24577)	28709 (21281, 37436)	53	41593 (31530, 53539)
13	0.66	1154 (472, 1802)	332204 (16989, 735889)	333358 (18283, 736372)	62.6	564212 (30090, 1247752)
14 (Apr)	0.86	6102 (737, 12521)	123598 (24729, 305268)	129700 (28930, 309191)	64.2	215590 (46167, 520415)
15	0.97	789 (196, 1474)	6582 (4601, 9092)	7371 (5447, 9722)	67.2	11945 (8685, 16023)
16	1.00	0	7301 (5579, 9083)	7301 (5579, 9083)	76.5	12375 (9456, 15395)
17	0.43	0	560049 (14162, 1473072)	560049 (14162, 1473072)	77	949236 (24003, 2496731)
18 (May)	0.79	0	427183 (99905, 1047812)	427183 (99905, 1047812)	75.4	724039 (169330, 1775952)
19	0.79	0	68304 (46144, 88514)	68304 (46144, 88514)	79	115769 (78211, 150024)
20	1.00	0	64942 (51690, 75970)	64942 (51690, 75970)	83.2	110071 (87610, 128764)
21	0.87	0	72081 (56504, 86964)	72081 (56504, 86964)	85.9	122171 (95770, 147397)

Table C3. (continued)

Week	Trap Effort	Fry (95% CI)	Pre-smolt/smolt (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
22 (Jun)	0.84	0	65188 (49867, 81649)	65188 (49867, 81649)	85.6	110488 (84521, 138388)
23	0.90	0	49400 (38983, 60100)	49400 (38983, 60100)	84.4	83729 (66073, 101865)
24	1.00	0	48674 (40416, 57766)	48674 (40416, 57766)	84.8	82498 (68502, 97908)
25	0.94	0	33241 (26817, 39919)	33241 (26817, 39919)	84.3	56341 (45453, 67660)
26	1.00	0	27965 (23601, 32365)	27965 (23601, 32365)	86.4	47398 (40002, 54856)
27 (Jul)	1.00	0	55326 (45188, 65428)	55326 (45188, 65428)	86	93773 (76590, 110895)
28	0.97	0	38331 (30574, 46530)	38331 (30574, 46530)	85.4	64968 (51821, 78864)
29	1.00	0	30585 (24987, 36416)	30585 (24987, 36416)	87.7	51839 (42351, 61722)
30	1.00	0	23095 (19849, 26334)	23095 (19849, 26334)	88.9	39144 (33642, 44634)
31 (Aug)	1.00	0	26774 (23117, 30633)	26774 (23117, 30633)	92	45380 (39181, 51920)
32	1.00	0	16551 (10894, 22711)	16551 (10894, 22711)	93.3	28053 (18464, 38493)
33	1.00	0	5768 (4069, 7678)	5768 (4069, 7678)	98	9776 (6897, 13014)
34	1.00	0	3946 (3034, 4920)	3946 (3034, 4920)	101.5	6688 (5142, 8339)
35 (Sep)	1.00	0	2737 (2000, 3491)	2737 (2000, 3491)	103.8	4639 (3390, 5917)
36	1.00	0	3544 (2005, 5413)	3544 (2005, 5413)	106	6007 (3398, 9175)
37	1.00	0	624 (335, 903)	624 (335, 903)	107.2	1058 (568, 1531)
38	1.00	0	623 (294, 979)	623 (294, 979)	113.5	1056 (498, 1659)
39	1.00	0	316 (80, 582)	316 (80, 582)	113.2	536 (136, 986)
40 (Oct)	1.00	0	309 (132, 474)	309 (132, 474)	117.1	524 (224, 803)
41	1.00	0	206 (60, 353)	206 (60, 353)	126.8	349 (102, 598)
42	0.97	0	307 (57, 693)	307 (57, 693)	131.6	520 (97, 1175)
43	1.00	0	288 (27, 702)	288 (27, 702)	144.4	488 (46, 1190)
44 (Nov)	0.97	0	0	0	-	0
45	0.89	0	79 (0, 189)	79 (0, 189)	149.7	134 (0, 320)
46	0.89	0	61 (0, 136)	61 (0, 136)	157.5	103 (0, 231)
47	0.80	0	0	0	-	0
BY 2022 total		2,852,999	2,138,941	4,991,942		6,478,325
95% CI		(1493348, 4358493)	(1159393, 3301514)	(3262758, 6821444)		(4241728, 8803784)

Table C4. Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for fall Chinook Salmon passing RBDD (RK 391) for the period 12/1/2023 through 11/30/2024 (brood year 2023). Trap sampling effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of the fry to pre-smolt/smolt survival rate (59% or 1.7:1; Hallock undated).

Week	Trap Effort	Fry (95% CI)	Pre-smolt/smolt (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
48 (Dec)	0.80	31 (0, 94)	0	31 (0, 94)	33	31 (0, 94)
49	0.86	901 (264, 1645)	0	901 (264, 1645)	34	901 (264, 1645)
50	0.86	2659 (1469, 4158)	0	2659 (1469, 4158)	34.5	2659 (1469, 4158)
51	0.89	32799 (13472, 55828)	0	32799 (13472, 55828)	35.3	32799 (13472, 55828)
52	0.49	25452 (1284, 67740)	0	25452 (1284, 67740)	36	25452 (1284, 67740)
1 (Jan)	0.86	159311 (77002, 275132)	0	159311 (77002, 275132)	36.1	159311 (77002, 275132)
2	0.74	98544 (48305, 157372)	0	98544 (48305, 157372)	36.5	98544 (48305, 157372)
3	0.71	272462 (135219, 426698)	0	272462 (135219, 426698)	37.2	272462 (135219, 426698)
4	0.51	275858 (130493, 482787)	7344 (1874, 16702)	283202 (137316, 486026)	37.7	288305 (142028, 488796)
5 (Feb)	0.29	73202 (55945, 92562)	129 (0, 278)	73331 (55945, 92840)	37.4	73421 (55945, 93033)
6	0.46	24041 (13780, 37486)	1838 (490, 3169)	25880 (15028, 40567)	38.1	27156 (15803, 42602)
7	0.66	57536 (22366, 119343)	1527 (1051, 1940)	59063 (23514, 121076)	38.1	60124 (24313, 122228)
8	0.00	31740 (13977, 62584)	2278 (800, 3558)	34018 (15874, 64968)	-	35600 (16997, 66823)
9 (Mar)	0.34	5943 (3467, 8691)	3029 (0, 5628)	8972 (3755, 14144)	42.5	11077 (3826, 18004)
10	0.69	17615 (12133, 22862)	26740 (16135, 37280)	44355 (28687, 59234)	48.2	62937 (40056, 84906)
11	0.74	15889 (10291, 22680)	16958 (10927, 22533)	32847 (22090, 43990)	48.8	44631 (29999, 59137)
12	0.54	8241 (5220, 12227)	23925 (19146, 28057)	32166 (27404, 36556)	53.1	48792 (41331, 55413)
13	0.29	2716 (1972, 3371)	109480 (39626, 192548)	112196 (42160, 195262)	61.7	188275 (69697, 329068)
14 (Apr)	1.00	670 (343, 1016)	30253 (8385, 67655)	30923 (8848, 68612)	65.4	51946 (14668, 115711)
15	0.71	255 (103, 415)	14421 (10820, 18107)	14676 (11037, 18450)	70.8	24697 (18533, 31030)
16	0.71	0	71565 (47911, 97797)	71565 (47911, 97797)	73.5	121297 (81205, 165758)
17	0.97	40 (0, 123)	65302 (46323, 86842)	65342 (46380, 86881)	77.7	110721 (78569, 147193)
18 (May)	0.97	0	105004 (64793, 164478)	105004 (64793, 164478)	79.4	177973 (109818, 278776)
19	1.00	0	130370 (89495, 180260)	130370 (89495, 180260)	80.3	220966 (151685, 305526)
20	1.00	0	45099 (34052, 57649)	45099 (34052, 57649)	81.8	76439 (57715, 97710)
21	0.97	0	104184 (53086, 163415)	104184 (53086, 163415)	82.6	176583 (89975, 276975)

Table C4. (continued)

Week	Trap Effort	Fry (95% CI)	Pre-smolt/smolt (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
22 (Jun)	0.83	0	39955 (28923, 53094)	39955 (28923, 53094)	81.5	67720 (49021, 89990)
23	0.80	0	11212 (8860, 13458)	11212 (8860, 13458)	81.3	19003 (15017, 22810)
24	0.80	0	14621 (7395, 19691)	14621 (7395, 19691)	85	24781 (12534, 33375)
25	0.80	0	14095 (7456, 19199)	14095 (7456, 19199)	86.4	23890 (12636, 32541)
26	0.69	0	18390 (13348, 23628)	18390 (13348, 23628)	86.8	31169 (22623, 40048)
27 (Jul)	0.97	0	7625 (6012, 9375)	7625 (6012, 9375)	87.5	12924 (10190, 15890)
28	1.00	0	4980 (3630, 6381)	4980 (3630, 6381)	90.8	8441 (6153, 10815)
29	1.00	0	3872 (2826, 5093)	3872 (2826, 5093)	94.3	6563 (4790, 8632)
30	0.86	0	3136 (2415, 3906)	3136 (2415, 3906)	96.3	5315 (4093, 6620)
31 (Aug)	1.00	0	1861 (1141, 2675)	1861 (1141, 2675)	96	3154 (1934, 4534)
32	0.97	0	1436 (1045, 1841)	1436 (1045, 1841)	99.2	2434 (1771, 3120)
33	0.83	0	710 (300, 1118)	710 (300, 1118)	101.1	1203 (508, 1895)
34	1.00	0	887 (545, 1287)	887 (545, 1287)	110.5	1503 (924, 2181)
35 (Sep)	1.00	0	574 (343, 827)	574 (343, 827)	107.7	973 (581, 1402)
36	1.00	0	71 (0, 160)	71 (0, 160)	107	120 (0, 271)
37	0.95	0	275 (54, 556)	275 (54, 556)	121	466 (92, 942)
38	0.90	0	538 (258, 848)	538 (258, 848)	124.6	912 (437, 1437)
39	0.93	0	1065 (722, 1436)	1065 (722, 1436)	123.6	1805 (1224, 2434)
40 (Oct)	0.95	0	633 (349, 956)	633 (349, 956)	127	1073 (592, 1620)
41	0.95	0	979 (831, 1125)	979 (831, 1125)	130.2	1659 (1408, 1907)
42	0.93	0	882 (498, 1251)	882 (498, 1251)	134.7	1495 (844, 2120)
43	0.95	0	771 (504, 1091)	771 (504, 1091)	136.1	1307 (854, 1849)
44 (Nov)	0.92	0	794 (546, 1109)	794 (546, 1109)	142.9	1346 (925, 1880)
45	0.97	0	210 (88, 363)	210 (88, 363)	153.1	356 (149, 615)
46	1.00	0	27 (0, 84)	27 (0, 84)	152	46 (0, 142)
47	0.43	0	67 (0, 199)	67 (0, 199)	156	114 (0, 337)
BY 2023 total		1,105,905	889,112	1,995,018		2,612,871
95% CI		(837318, 1393512)	(751732, 1019746)	(1692833, 2302325)		(2250773, 2960210)

Table C5.— Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for spring Chinook Salmon passing RBDD (RK 391) for the period 10/16/2020 through 10/15/2021 (brood year 2020). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of a fry to pre-smolt/smolt survival rate (59% or 1.7:1; Hallock undated).

Week	Trap Effort	Fry (95% CI)	Pre-smolt/smolt (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
42	1.00	0	0	0	-	0
43	1.00	0	0	0	-	0
44 (Nov)	0.97	0	0	0	-	0
45	0.97	0	0	0	-	0
46	1.00	0	0	0	-	0
47	0.97	4502 (2923, 6471)	0	4502 (2923, 6471)	35	4502 (2923, 6471)
48 (Dec)	0.71	9168 (6408, 11944)	0	9168 (6408, 11944)	35.4	9168 (6408, 11944)
49	1.00	7333 (6274, 8374)	161 (22, 392)	7494 (6366, 8688)	38	7606 (6409, 8926)
50	0.91	4426 (2794, 6091)	256 (95, 431)	4681 (2961, 6396)	38.9	4860 (3070, 6607)
51	1.00	4354 (1559, 8445)	138 (43, 265)	4492 (1710, 8557)	40.1	4588 (1814, 8614)
52	0.78	2049 (1010, 3301)	1044 (567, 1589)	3093 (1781, 4468)	45.2	3818 (2263, 5381)
1 (Jan)	0.96	2203 (198, 5700)	1526 (112, 4200)	3728 (334, 9888)	46.4	4789 (422, 12822)
2	0.91	316 (167, 476)	765 (531, 1001)	1081 (765, 1435)	51	1613 (1146, 2123)
3	1.00	0	1992 (919, 3159)	1992 (919, 3159)	52.5	3376 (1558, 5354)
4	0.93	0	4836 (1710, 9596)	4836 (1710, 9596)	53.9	8197 (2898, 16264)
5 (Feb)	0.79	0	12481 (5172, 21108)	12481 (5172, 21108)	55.9	21154 (8766, 35777)
6	0.94	0	2741 (359, 6018)	2741 (359, 6018)	56	4646 (608, 10200)
7	0.90	0	1043 (378, 1804)	1043 (378, 1804)	59.1	1768 (641, 3058)
8	0.94	0	233 (129, 334)	233 (129, 334)	61.3	395 (219, 566)
9 (Mar)	1.00	0	581 (347, 861)	581 (347, 861)	67	985 (588, 1459)
10	1.00	0	108 (58, 156)	108 (58, 156)	67.8	183 (98, 264)
11	0.74	0	400456 (32200, 1052519)	400456 (32200, 1052519)	74.5	678739 (54576, 1783930)
12	0.51	0	125589 (31808, 222403)	125589 (31808, 222403)	76.1	212863 (53912, 376954)
13	0.80	0	25998 (7016, 57641)	25998 (7016, 57641)	78.9	44064 (11892, 97697)
14 (Apr)	0.40	0	6391 (3410, 10235)	6391 (3410, 10235)	83.4	10832 (5780, 17347)
15	0.39	0	86221 (14005, 140169)	86221 (14005, 140169)	83.8	146137 (23737, 237573)

Table C5. (continued)

Week	Trap Effort	Fry (95% CI)	Pre-smolt/smolt (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
16	0.80	0	10055 (7168, 13819)	10055 (7168, 13819)	88.7	17042 (12149, 23422)
17	0.87	0	13325 (8989, 17556)	13325 (8989, 17556)	93.1	22585 (15236, 29756)
18 (May)	0.81	0	8528 (4077, 15661)	8528 (4077, 15661)	96.3	14454 (6910, 26545)
19	0.79	0	3422 (1751, 5470)	3422 (1751, 5470)	101.3	5800 (2968, 9272)
20	0.77	0	1301 (868, 1747)	1301 (868, 1747)	105.5	2205 (1471, 2961)
21	0.86	0	427 (136, 844)	427 (136, 844)	109.8	724 (231, 1431)
22 (Jun)	0.83	0	31 (0, 94)	31 (0, 94)	112	53 (0, 159)
23	0.89	0	30 (0, 93)	30 (0, 93)	118	51 (0, 158)
24	0.74	0	0	0	-	0
25	0.77	0	0	0	-	0
26	0.80	0	0	0	-	0
27 (Jul)	0.54	0	0	0	-	0
28	0.80	0	0	0	-	0
29	0.80	0	0	0	-	0
30	0.80	0	0	0	-	0
31 (Aug)	0.80	0	0	0	-	0
32	0.83	0	0	0	-	0
33	0.89	0	0	0	-	0
34	0.86	0	0	0	-	0
35 (Sep)	0.86	0	0	0	-	0
36	1.00	0	0	0	-	0
37	1.00	0	0	0	-	0
38	1.00	0	0	0	-	0
39	1.00	0	0	0	-	0
40 (Oct)	0.94	0	0	0	-	0
41	0.91	0	0	0	-	0
BY 2020 total		34,351	709,679	744,028		1,237,197
95% CI		(28560, 40802)	(288233, 1366662)	(323640, 1401446)		(523560, 2350964)

Table C6.— Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for spring Chinook Salmon passing RBDD (RK 391) for the period 10/16/2021 through 10/15/2022 (brood year 2021). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of the fry to pre-smolt/smolt survival rate (59% or 1.7:1; Hallock undated).

Week	Trap Effort	Fry (95% CI)	Pre-smolt/smolt (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
42	0.89	0	0	0	-	0
43	0.71	0	0	0	-	0
44 (Nov)	0.89	0	0	0	-	0
45	0.89	4226 (1533, 8153)	0	4226 (1533, 8153)	32.4	4226 (1533, 8153)
46	0.89	4377 (3049, 5923)	0	4377 (3049, 5923)	33.1	4377 (3049, 5923)
47	0.83	8013 (5314, 10659)	0	8013 (5314, 10659)	33.2	8013 (5314, 10659)
48 (Dec)	0.86	18289 (14954, 21681)	0	18289 (14954, 21681)	33.9	18289 (14954, 21681)
49	1.00	5993 (3584, 8720)	0	5993 (3584, 8720)	36.2	5993 (3584, 8720)
50	0.71	13567 (2581, 32864)	134 (0, 415)	13701 (2581, 33261)	37.7	13794 (2581, 33536)
51	0.84	9365 (3181, 16890)	405 (32, 965)	9770 (3535, 17379)	40.4	10051 (3765, 17710)
52	0.58	2820 (1544, 4489)	605 (127, 1362)	3425 (1849, 5286)	42.8	3845 (2040, 6050)
1 (Jan)	0.84	964 (314, 1935)	912 (264, 1841)	1876 (649, 3769)	45.6	2510 (853, 5054)
2	0.93	1213 (365, 2209)	1689 (728, 2789)	2902 (1209, 4721)	47.3	4076 (1751, 6611)
3	0.91	0	89 (0, 272)	89 (0, 272)	47	151 (0, 461)
4	0.90	0	68 (0, 206)	68 (0, 206)	63	115 (0, 349)
5 (Feb)	0.91	0	21 (0, 65)	21 (0, 65)	53	36 (0, 110)
6	1.00	0	0	0	-	0
7	0.97	0	45 (0, 138)	45 (0, 138)	61	76 (0, 234)
8	1.00	0	89 (0, 271)	89 (0, 271)	62.8	151 (0, 459)
9 (Mar)	0.99	0	96 (22, 196)	96 (22, 196)	64	163 (37, 332)
10	0.90	0	210 (54, 386)	210 (54, 386)	69.4	356 (92, 654)
11	0.70	0	13115 (91, 39399)	13115 (91, 39399)	71.8	22229 (154, 66779)
12	0.47	0	30183 (24602, 37894)	30183 (24602, 37894)	74.1	51158 (41698, 64226)
13	0.96	0	22432 (13720, 32799)	22432 (13720, 32799)	77.6	38020 (23254, 55592)
14 (Apr)	0.49	0	21190 (9313, 41705)	21190 (9313, 41705)	80.7	35915 (15785, 70687)
15	0.80	0	19642 (11887, 27237)	19642 (11887, 27237)	86.2	33292 (20147, 46164)

Table C6. (continued)

Week	Trap Effort	Fry (95% CI)	Pre-smolt/smolt (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
16	0.61	0	24249 (12964, 41113)	24249 (12964, 41113)	90.8	41100 (21973, 69684)
17	1.00	0	7562 (4423, 12480)	7562 (4423, 12480)	93.2	12817 (7497, 21153)
18 (May)	1.00	0	2409 (1282, 3714)	2409 (1282, 3714)	96.7	4083 (2173, 6295)
19	1.00	0	1913 (1115, 2871)	1913 (1115, 2871)	102.6	3242 (1890, 4866)
20	1.00	0	244 (108, 372)	244 (108, 372)	104.8	414 (183, 631)
21	1.00	0	92 (21, 186)	92 (21, 186)	107	156 (36, 315)
22 (Jun)	0.66	0	0	0	-	0
23	0.80	0	72 (0, 173)	72 (0, 173)	122.3	122 (0, 293)
24	0.80	0	0	0	-	0
25	0.80	0	0	0	-	0
26	0.80	0	0	0	-	0
27 (Jul)	0.97	0	0	0	-	0
28	0.91	0	0	0	-	0
29	0.91	0	0	0	-	0
30	0.91	0	0	0	-	0
31 (Aug)	0.91	0	0	0	-	0
32	0.77	0	0	0	-	0
33	0.89	0	0	0	-	0
34	0.91	0	0	0	-	0
35 (Sep)	0.91	0	0	0	-	0
36	0.91	0	0	0	-	0
37	0.91	0	0	0	-	0
38	0.89	0	0	0	-	0
39	0.91	0	0	0	-	0
40 (Oct)	0.94	0	0	0	-	0
41	0.91	0	0	0	-	0
BY 2021 total		68,827	147,466	216,293		318,770
95% CI		(52427, 89644)	(114673, 184660)	(178835, 257580)	-	(260689, 383581)

Table C7.— Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for spring Chinook Salmon passing RBDD (RK 391) for the period 10/16/2022 through 10/15/2023 (brood year 2022). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of a fry to pre-smolt/smolt survival rate (59% or 1.7:1; Hallock undated).

Week	Trap Effort	Fry (95% CI)	Pre-smolt/smolt (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
42	0.91	0	0	0	-	0
43	0.91	0	0	0	-	0
44 (Nov)	0.91	0	0	0	-	0
45	0.89	0	0	0	-	0
46	0.91	663 (242, 1141)	0	663 (242, 1141)	36.4	663 (242, 1141)
47	0.57	3141 (2428, 3941)	0	3141 (2428, 3941)	35	3141 (2428, 3941)
48 (Dec)	0.80	11469 (9386, 13841)	0	11469 (9386, 13841)	35.4	11469 (9386, 13841)
49	0.59	6137 (2840, 9833)	0	6137 (2840, 9833)	36.4	6137 (2840, 9833)
50	0.81	11284 (4684, 19151)	90 (0, 281)	11374 (4752, 19224)	38.3	11437 (4811, 19249)
51	0.89	1237 (696, 1848)	64 (17, 121)	1301 (750, 1933)	39.8	1345 (781, 1994)
52	0.45	2942 (1103, 4984)	2802 (745, 5226)	5745 (2321, 8930)	44	7691 (2882, 12335)
1 (Jan)	0.44	1246 (0, 3088)	761 (0, 1705)	2007 (515, 3276)	46.7	2536 (873, 3785)
2	0.00	623 (0, 1544)	4785 (3178, 6352)	5408 (3707, 7103)	-	8734 (5984, 11454)
3	0.43	0	8809 (5649, 11905)	8809 (5649, 11905)	53.5	14931 (9575, 20178)
4	0.86	0	2372 (878, 4232)	2372 (878, 4232)	54.8	4020 (1488, 7173)
5 (Feb)	0.83	0	208 (0, 464)	208 (0, 464)	60.5	353 (0, 786)
6	1.00	0	357 (74, 700)	357 (74, 700)	59.4	605 (125, 1186)
7	1.00	0	72 (22, 138)	72 (22, 138)	63	122 (37, 234)
8	1.00	0	48 (0, 146)	48 (0, 146)	61	81 (0, 247)
9 (Mar)	0.81	0	881 (29, 2437)	881 (29, 2437)	72.6	1493 (49, 4131)
10	0.57	0	141 (0, 306)	141 (0, 306)	68.7	239 (0, 519)
11	0.11	0	2107 (1735, 2540)	2107 (1735, 2540)	81	3571 (2941, 4305)
12	0.77	0	766 (335, 1189)	766 (335, 1189)	72.1	1298 (568, 2015)
13	0.66	0	72549 (1419, 174479)	72549 (1419, 174479)	76.7	122964 (2405, 295727)
14 (Apr)	0.86	0	18349 (2197, 49218)	18349 (2197, 49218)	78.7	31100 (3724, 83420)
15	0.97	0	3137 (2056, 4332)	3137 (2056, 4332)	86.7	5317 (3485, 7343)

Table C7. (continued)

Week	Trap Effort	Fry (95% CI)	Pre-smolt/smolt (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
16	1.00	0	2502 (1831, 3180)	2502 (1831, 3180)	89.5	4241 (3103, 5390)
17	0.43	0	53991 (4173, 146070)	53991 (4173, 146070)	90	91510 (7073, 247577)
18 (May)	0.79	0	2560 (1288, 3722)	2560 (1288, 3722)	95.2	4339 (2183, 6308)
19	0.79	0	1214 (763, 1664)	1214 (763, 1664)	99.9	2058 (1293, 2820)
20	1.00	0	1449 (1088, 1824)	1449 (1088, 1824)	104.3	2456 (1844, 3092)
21	0.87	0	755 (424, 1065)	755 (424, 1065)	109.1	1280 (719, 1805)
22 (Jun)	0.84	0	495 (134, 979)	495 (134, 979)	114.9	839 (227, 1659)
23	0.90	0	200 (65, 359)	200 (65, 359)	127	339 (110, 608)
24	1.00	0	108 (30, 204)	108 (30, 204)	127.3	183 (51, 346)
25	0.94	0	0	0	-	0
26	1.00	0	32 (0, 100)	32 (0, 100)	136	54 (0, 169)
27 (Jul)	1.00	0	70 (0, 162)	70 (0, 162)	144	119 (0, 275)
28	0.97	0	0	0	-	0
29	1.00	0	0	0	-	0
30	1.00	0	0	0	-	0
31 (Aug)	1.00	0	0	0	-	0
32	1.00	0	0	0	-	0
33	1.00	0	0	0	-	0
34	1.00	0	0	0	-	0
35 (Sep)	1.00	0	0	0	-	0
36	1.00	0	0	0	-	0
37	1.00	0	0	0	-	0
38	1.00	0	0	0	-	0
39	1.00	0	0	0	-	0
40 (Oct)	1.00	0	0	0	-	0
41	1.00	0	0	0	-	0
BY 2022 total		38,742	181,674	220,417		346,665
95% CI		(30367, 48134)	(66329, 310956)	(105496, 352988)		(151647, 567751)

Table C8.— Week, weekly trap sampling effort, passage estimates with 95% confidence intervals (CI), mean fork length (mm) and juvenile production indices (JPI's) for spring Chinook Salmon passing RBDD (RK 391) for the period 10/16/2023 through 10/15/2024 (brood year 2023). Trap effort indicated by assigning a value of 1.00 to a week consisting of (4) 1.5-m and (1) 2.4-m diameter rotary-screw traps sampling 7 days per week. Results include estimated passage for fry (< 46 mm FL), pre-smolt/smolts (> 45 mm FL), total (fry and pre-smolt/smolts combined) and fry-equivalents. Fry-equivalent JPI's generated by weighting pre-smolt/smolt passage by the inverse of the fry to pre-smolt/smolt survival rate (59% or 1.7:1; Hallock undated).

Week	Trap Effort	Fry (95% CI)	Pre-smolt/smolt (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
42	0.97	0	0	0	-	0
43	1.00	0	0	0	-	0
44 (Nov)	0.97	0	0	0	-	0
45	0.89	0	0	0	-	0
46	0.89	0	0	0	-	0
47	0.80	0	0	0	-	0
48 (Dec)	0.80	0	0	0	-	0
49	0.86	3544 (2197, 4763)	95 (0, 227)	3639 (2413, 4763)	37.8	3705 (2564, 4764)
50	0.86	905 (426, 1442)	251 (128, 357)	1156 (619, 1740)	41.2	1330 (740, 1945)
51	0.89	5152 (963, 12818)	1991 (433, 4630)	7143 (1739, 14658)	43.3	8527 (2257, 16515)
52	0.49	520 (0, 1193)	215 (0, 643)	736 (0, 1491)	44.1	884 (0, 1809)
1 (Jan)	0.86	893 (25, 2168)	338 (32, 779)	1230 (137, 2525)	46.7	1466 (219, 2844)
2	0.74	0	375 (39, 856)	375 (39, 856)	54.2	636 (66, 1451)
3	0.71	0	969 (592, 1395)	969 (592, 1395)	50.8	1642 (1003, 2364)
4	0.51	0	2110 (1416, 2746)	2110 (1416, 2746)	55.1	3576 (2400, 4654)
5 (Feb)	0.29	0	483 (201, 800)	483 (201, 800)	55.8	819 (341, 1356)
6	0.46	0	1960 (512, 3328)	1960 (512, 3328)	59.4	3322 (868, 5641)
7	0.66	0	1205 (506, 1998)	1205 (506, 1998)	60.1	2042 (858, 3386)
8	0.00	0	1210 (521, 1991)	1210 (521, 1991)	-	2052 (883, 3375)
9 (Mar)	0.34	0	1216 (0, 2672)	1216 (0, 2672)	73.5	2061 (0, 4529)
10	0.69	0	13552 (7395, 20462)	13552 (7395, 20462)	71.6	22969 (12534, 34681)
11	0.74	0	10107 (6321, 13777)	10107 (6321, 13777)	73.6	17131 (10713, 23351)
12	0.54	0	14308 (12014, 16413)	14308 (12014, 16413)	76.2	24251 (20363, 27819)
13	0.29	0	104123 (29652, 193214)	104123 (29652, 193214)	78.2	176480 (50257, 327481)
14 (Apr)	1.00	0	34986 (9915, 80760)	34986 (9915, 80760)	81.7	59298 (16804, 136882)
15	0.71	0	15394 (11617, 19617)	15394 (11617, 19617)	85.7	26092 (19690, 33249)

Table C8. (continued)

Week	Trap Effort	Fry (95% CI)	Pre-smolt/smolt (95% CI)	Total Passage (95% CI)	Mean FL (mm)	Fry-equivalent JPI (95% CI)
16	0.71	0	28484 (22558, 33968)	28484 (22558, 33968)	89.9	48278 (38234, 57573)
17	0.97	0	28795 (22194, 35313)	28795 (22194, 35313)	93.6	48805 (37617, 59853)
18 (May)	0.97	0	24784 (14904, 35812)	24784 (14904, 35812)	97.2	42007 (25260, 60698)
19	1.00	0	9072 (5737, 12931)	9072 (5737, 12931)	100.6	15376 (9724, 21917)
20	1.00	0	1515 (815, 2314)	1515 (815, 2314)	103.8	2568 (1381, 3922)
21	0.97	0	2019 (859, 3580)	2019 (859, 3580)	108.3	3422 (1456, 6068)
22 (Jun)	0.83	0	128 (39, 230)	128 (39, 230)	111.7	217 (66, 390)
23	0.80	0	78 (0, 252)	78 (0, 252)	130	132 (0, 427)
24	0.80	0	29 (0, 97)	29 (0, 97)	125	49 (0, 164)
25	0.80	0	30 (0, 100)	30 (0, 100)	124	51 (0, 169)
26	0.69	0	45 (0, 139)	45 (0, 139)	146	76 (0, 236)
27 (Jul)	0.97	0	37 (0, 116)	37 (0, 116)	136	63 (0, 197)
28	1.00	0	0	0	-	0
29	1.00	0	0	0	-	0
30	0.86	0	0	0	-	0
31 (Aug)	1.00	0	0	0	-	0
32	0.97	0	0	0	-	0
33	0.83	0	0	0	-	0
34	1.00	0	0	0	-	0
35 (Sep)	1.00	0	0	0	-	0
36	1.00	0	0	0	-	0
37	0.95	0	0	0	-	0
38	0.90	0	0	0	-	0
39	0.93	0	0	0	-	0
40 (Oct)	0.95	0	0	0	-	0
41	0.95	0	0	0	-	0
BY 2023 total		11,014	299,904	310,918		519,327
95% CI		(6015, 18958)	(203448, 402555)	(213923, 414354)		(355088, 693378)