# Track-a-Cohort

# Real-Time Assessments

# Annual Brood Year Assessment Indicators

Jennifer L. Gosselin[1], Lillian McCormick[2], Grace Easterbrook[2],
Tony Yang[2], Lisa Elliott[2] and Susannah Iltis[1]

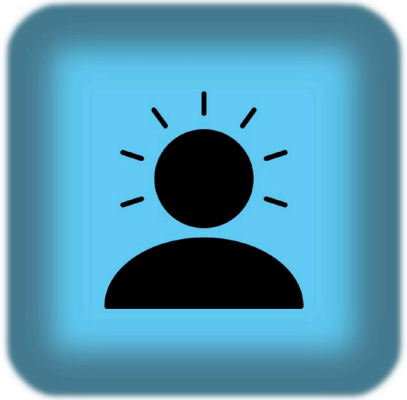
1 SacPAS CENTRAL VALLEY PREDICTION AND ASSESSMENT OF SALMON

2 BUREAU OF RECLAMATION

# Three presentations to cover three major tools for the Delta Actions Team (DAT)

1) Track-a-Cohort (daily)
2) Real-Time Assessments (weekly)
3) Annual Brood Year Assessment Indicators (annually)

**Overview and walkthrough for awareness of tools. Additional details about some of the metrics and outputs in later presentations**



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## Workgroups & Teams

*Customized data visualizations, biological thresholds, and data tables of current conditions with recent and real-time data to facilitate in-season monitoring and management by Central Valley Workgroups and Monitoring Teams.*

RESOURCES

Water Operations and Watershed Monitoring Technical Teams, BDO, BOR

DELTA ACTIONS TEAM

Real-time Assessments

Track-a-Cohort

PA 3.3.3 Winter Chinook

Chinook and Steelhead

Delta Smelt and Longfin Smelt

more DAT

STANISLAUS WATERSHED TEAM

Temperature and Flow

Current River Conditions

Water Temperature Hist. & Current

more SWT

SACRAMENTO RIVER TECHNICAL GROUP

Fall Flow Redd Dewatering

SAN JOAQUIN R RESTORATION PROGRAM

Allocation Management

Restoration Flow Volumes

Daily Flow Hydrograph

more SJRRP

AMERICAN RIVER GROUP

Temperature and Flow

## Access

Data and decision support tools on fishes and environmental conditions

## Research

Fish survival and migration models, presentations, and publications

## Connections

Collaborators, practitioners, stakeholders, students, knowledge, and experiences

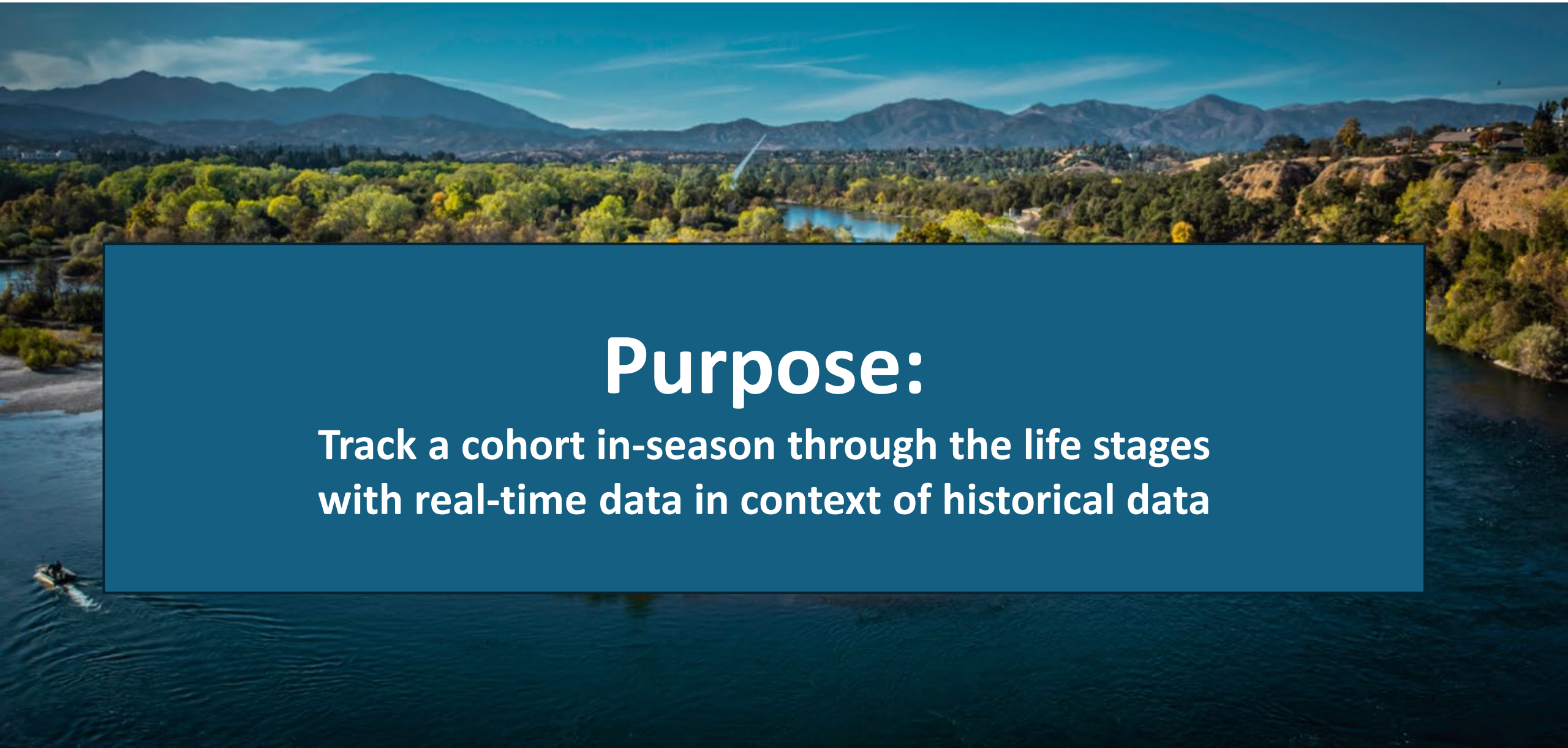





# Track-a-Cohort



# Track-a-Cohort



## Purpose:

Track a cohort in-season through the life stages with real-time data in context of historical data

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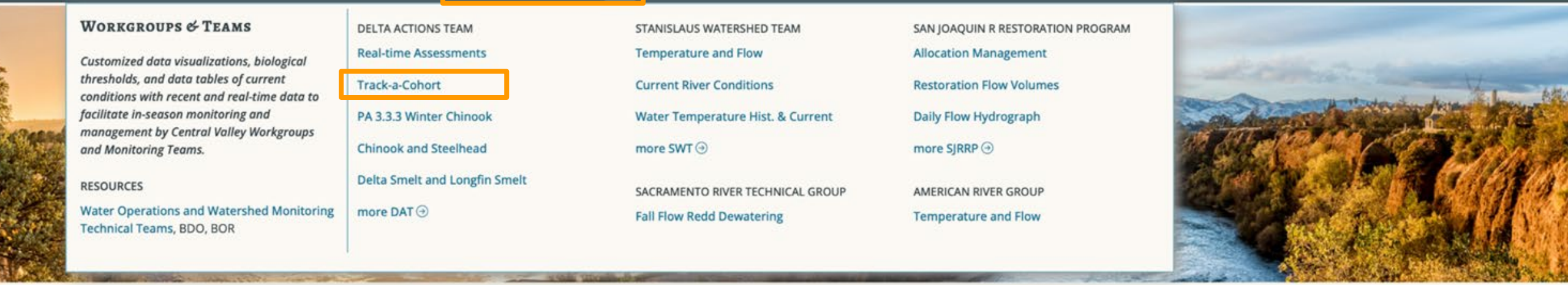
Restoration Flow Volumes

Daily Flow Hydrograph

more SJRRP

AMERICAN RIVER GROUP

Temperature and Flow



## Access

Data and decision support tools on fishes and environmental conditions

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# Track-a-Cohort -- Winter Chinook

Provides in-season, real-time data in comparison to data in historical years. Post-season, Track-a-Cohort also provides the latest annual data summaries.

Winter-run Chinook | Steelhead

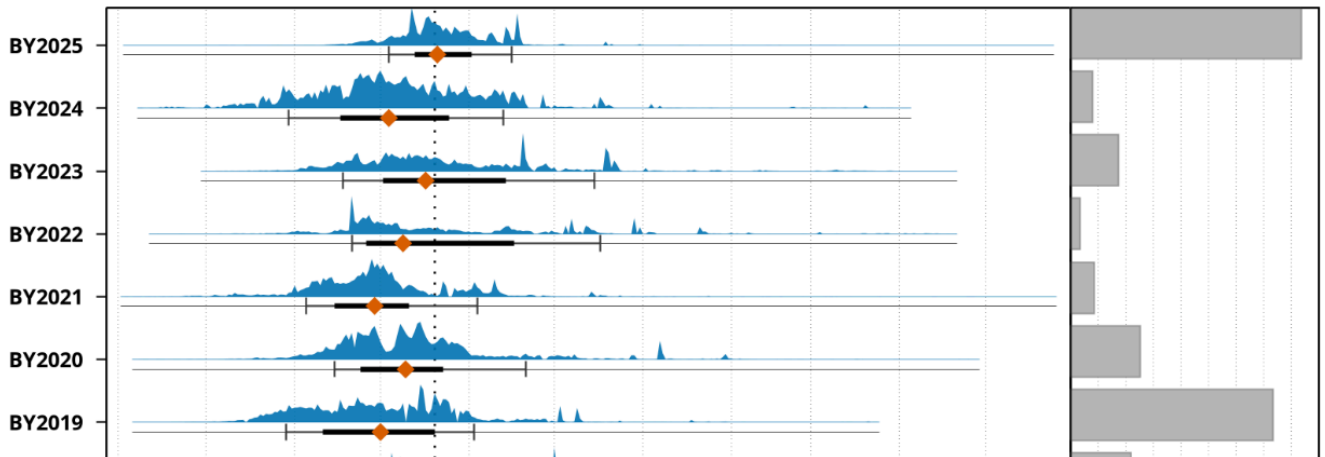
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- Juveniles in River
  - Migration Timing — annual data
  - Today Percent
  - Current Catch
- Juveniles in Delta ▶
- Adults in Ocean ▶
- Adults in River ▶


## Juveniles in River

### Migration Timing — annual data

**Density with Migration Timing, Brood Year 2010 - 2025**
**Juvenile Unmarked (not mark-corrected) Winter Chinook**
**Red Bluff Diversion Dam, 7/1 - 6/30**

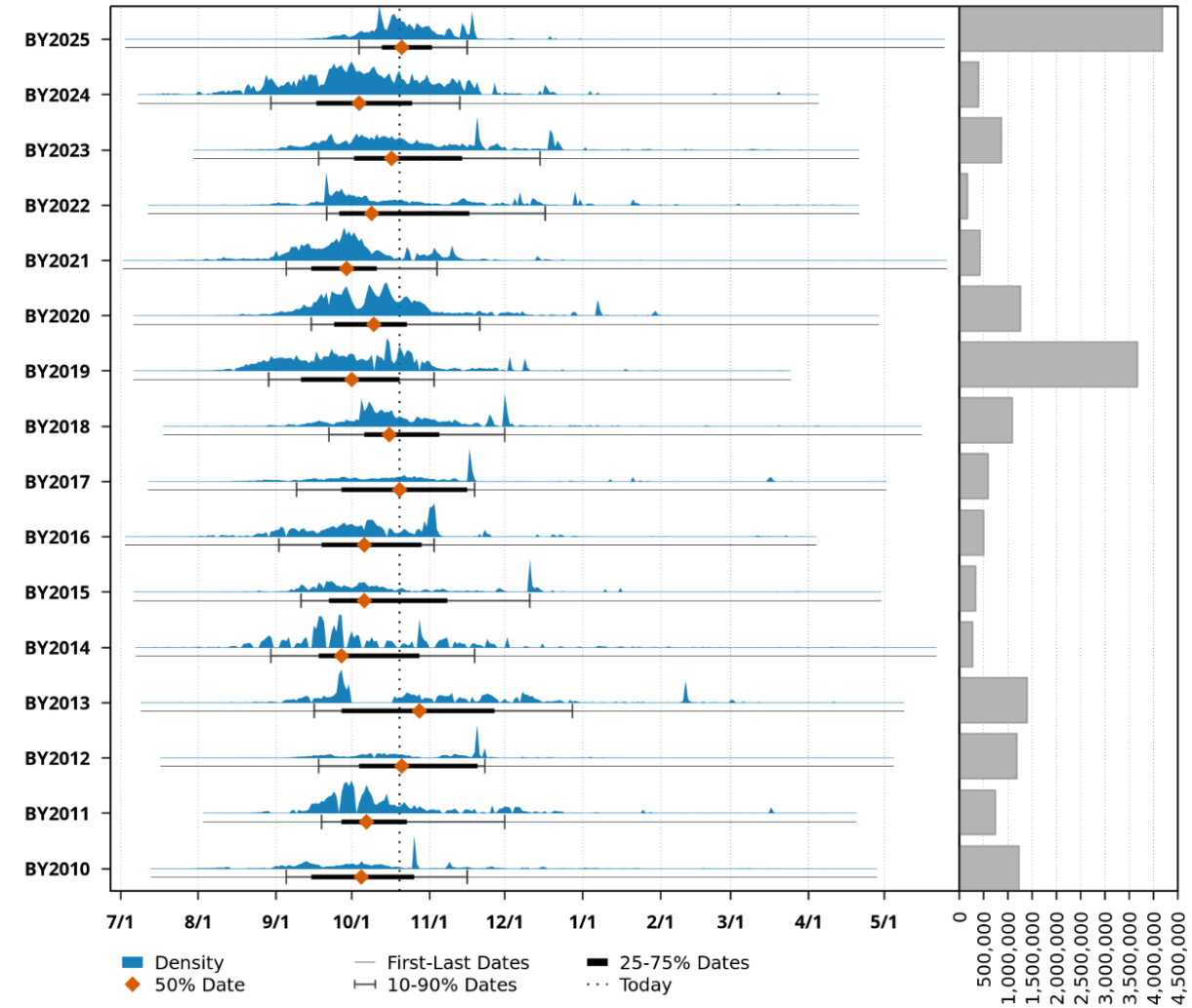


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Juveniles in River ▼
- Migration Timing — annual data
- Today Percent
- Current Catch

Juveniles in Delta ▶
Adults in Ocean ▶
Adults in River ▶

**Density with Migration Timing, Brood Year 2010 - 2025**
**Juvenile Unmarked (not mark-corrected) Winter Chinook**
**Red Bluff Diversion Dam, 7/1 - 6/30**




Y-axis upper limit set to max of data in each year.
Based on Daily Estimated Passage; method updated BY2020. Preliminary data from USFWS Red Bluff; subject to revision.
No sampling 2020-03-25 to 2020-06-30.

**# Passage Estimate**

www.cbr.washington.edu/sacramento/ • 21 Oct 2026 08:15:21 PDT

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Juveniles in River ▼

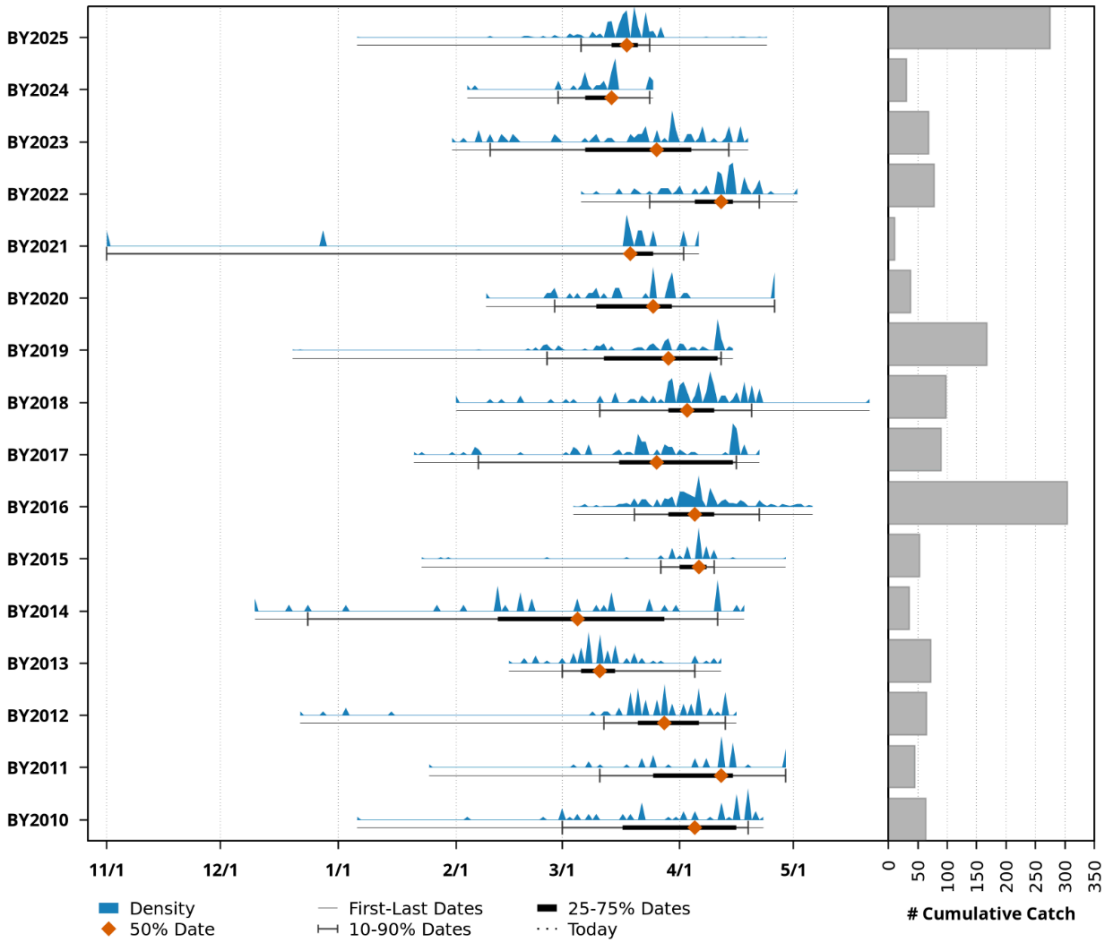
- Migration Timing — annual data
- Today Percent
- Current Catch

Juveniles in Delta ▶

Adults in Ocean ▶

Adults in River ▶

**Density with Migration Timing, Brood Year 2010 - 2025**
**Juvenile Unclipped Winter Chinook**
**Chipps Island Trawls (Raw Catch), 7/1 - 6/30**




Y-axis upper limit set to max of data in each year.
Based on Raw Catch. Preliminary data from USFWS Lodi; subject to revision.

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Related Query

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Juveniles in River

Migration Timing — annual data

Today Percent

Current Catch

Juveniles in Delta

Adults in Ocean

Adults in River

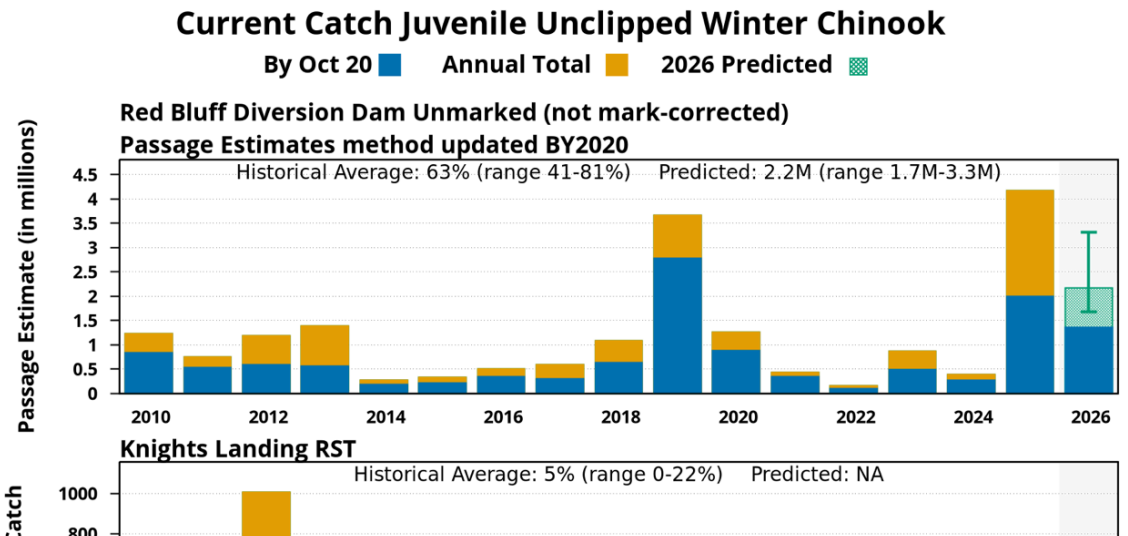
## Today Percent

**Average Percent by 10/20, with 95%CI, of annual emigrating population for juveniles of each species of interest captured at the following locations and salvaged at SWP and CVP Delta facilities**

| Species | Red Bluff Diversion Dam | Tisdale RST | Knights Landing RST | Sac Trawl (Sherwood) Catch Index | Chipps Island Trawl Catch Index | Salvage |
|---|---|---|---|---|---|---|
| Chinook, LAD Winter-run, Unclipped | 64.0% (57.0%,71.1%) BY: 2015 - 2025 | 6.6% (1.7%,11.5%) BY: 2015 - 2025 | 7.8% (3.8%,11.9%) BY: 2015 - 2025 | 0.0% (0.0%,0.0%) BY: 2015 - 2025 | 0.0% (0.0%,0.0%) BY: 2015 - 2025 | 0.0% (0.0%,0.0%) WY: 2017 - 2026 |

Calculations generated by SacPAS Migration Timing and Conditions by Cohort and Salvage Timing.
Data Courtesy of USFWS, Red Bluff; CDFW via StreamNet and CDEC; USFWS, Lodi.

## Current Catch



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Juveniles in River ▼

Migration Timing — annual data

Today Percent

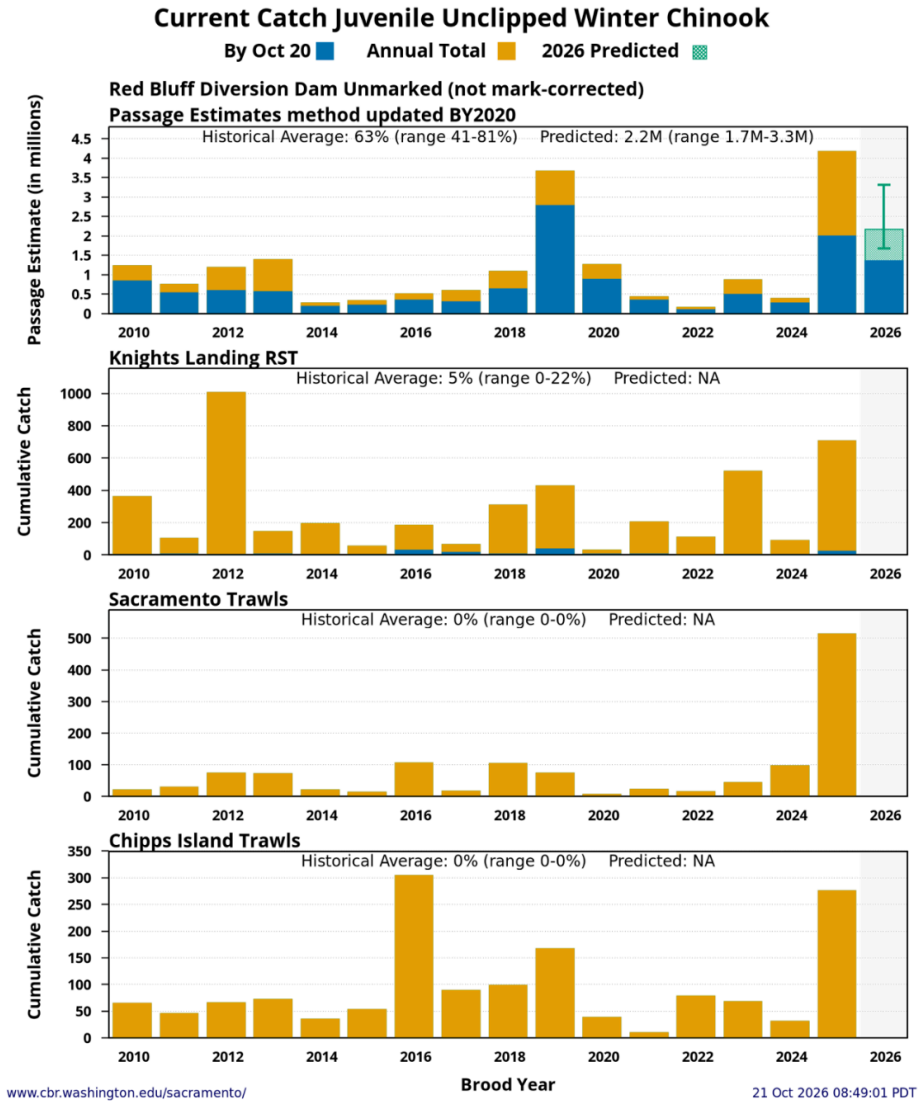
Current Catch

Juveniles in Delta ▶

Adults in Ocean ▶

Adults in River ▶

## Current Catch



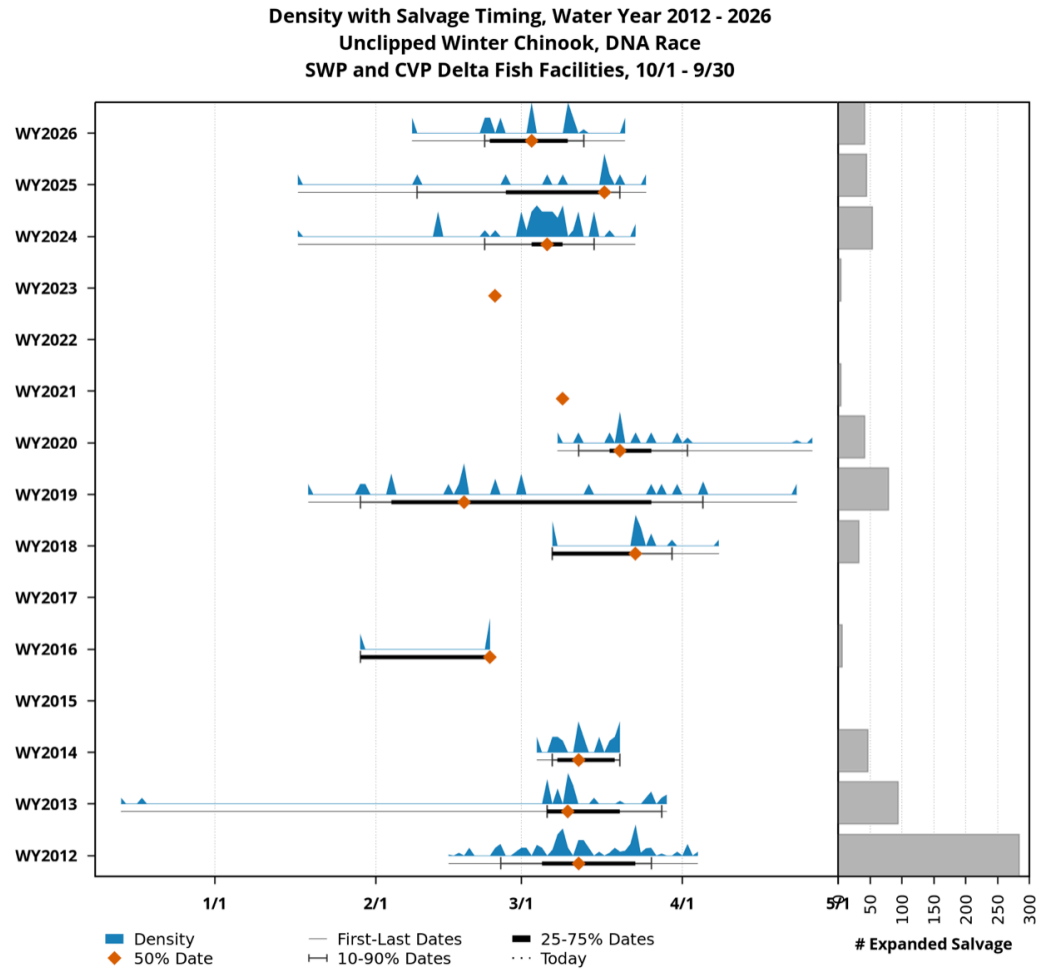

Related Query

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- Juveniles in River
- Juveniles in Delta
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  - Juvenile Production Estimate JPE — annual data
  - Delta STARS Survival and Routing Probabilities
  - Percent Loss of Juvenile Production Estimate (JPE)
  - Loss
  - Daily Loss and Export with OMR
  - Loss Single Year Thresholds
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- Adults in Ocean
- Adults in River

# Juveniles in Delta

## Salvage Timing — annual data



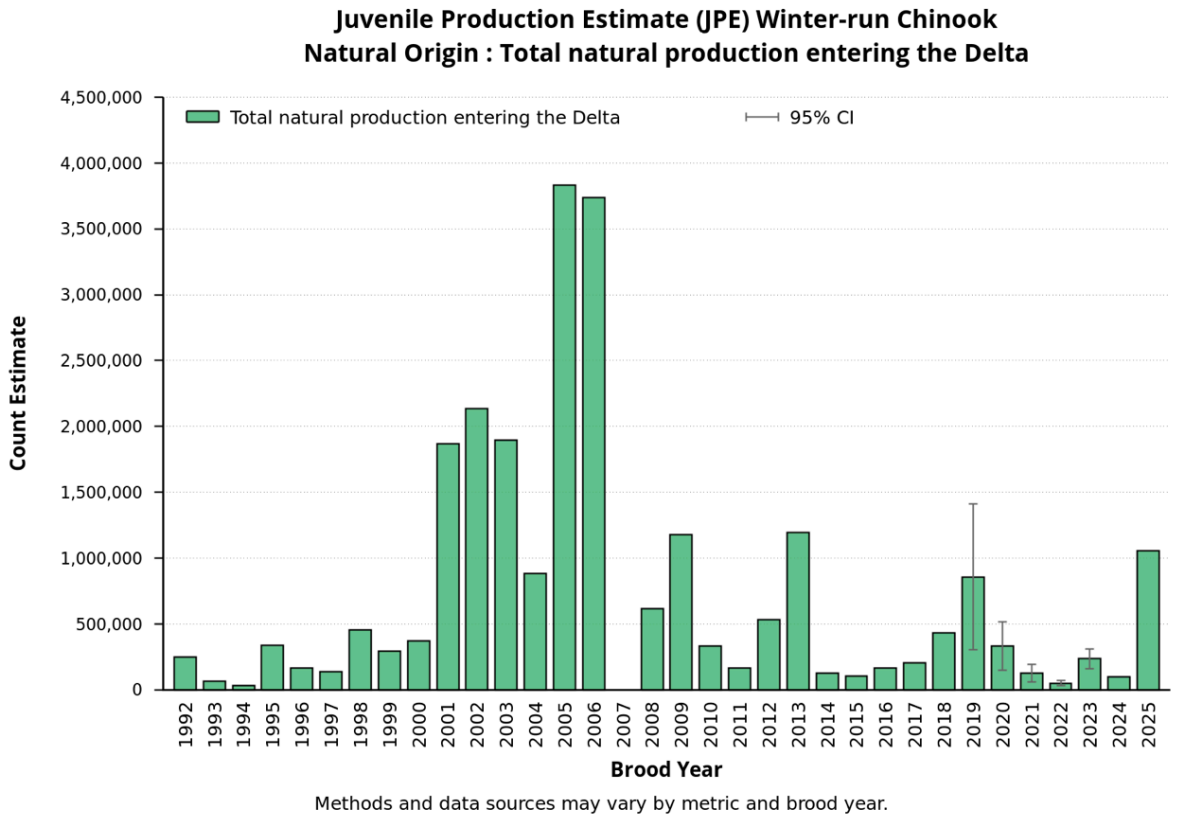

Y-axis upper limit set to max of data in each year.
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21 Oct 2026 08:15:26 PDT

# Juvenile Production Estimate JPE — annual data

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- Juveniles in Delta ▼
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  - Predicted Weekly Loss
- Adults in Ocean ▶
- Adults in River ▶




Methods and data sources may vary by metric and brood year.

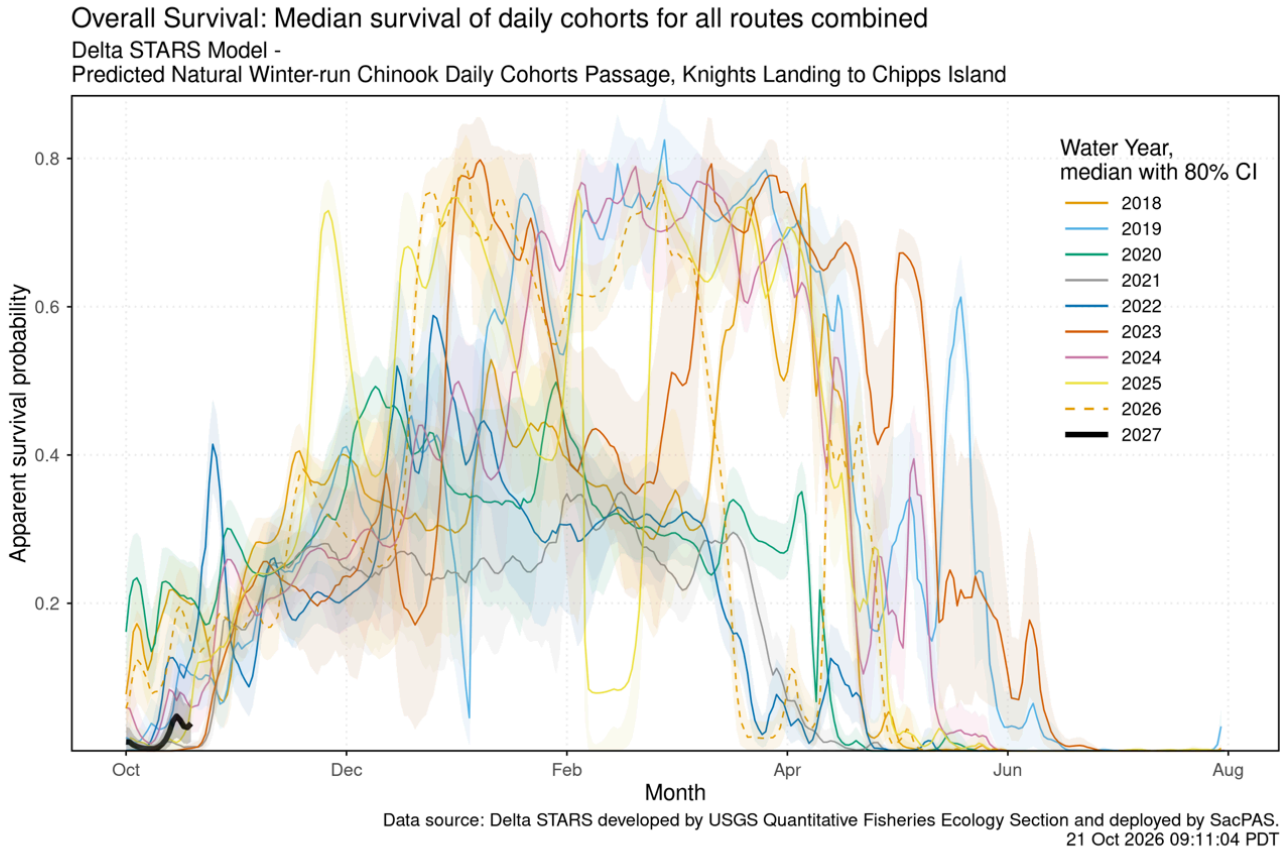
www.cbr.washington.edu/sacramento/ 12 Aug 2026 14:22:05 PDT

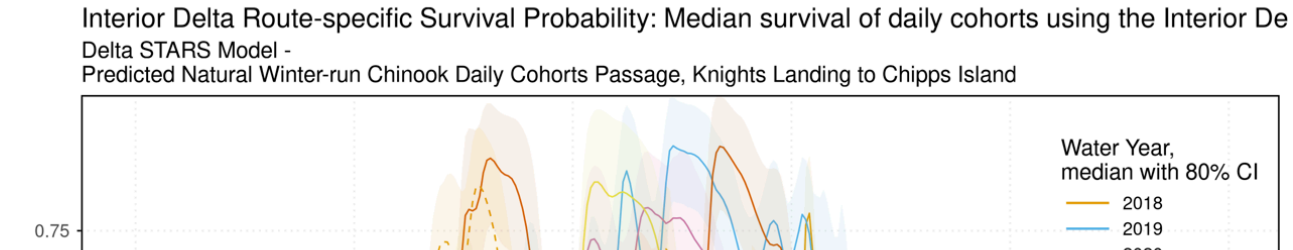
GitHub Repo | Related Query | JPE Methods | PNG 150 DPI | PNG 300 DPI

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Adults in River ▶

# Delta STARS Survival and Routing Probabilities




**STARS**:

**S**urvival
**T**ravel Time
**A**nd
**R**outing
**S**imulation

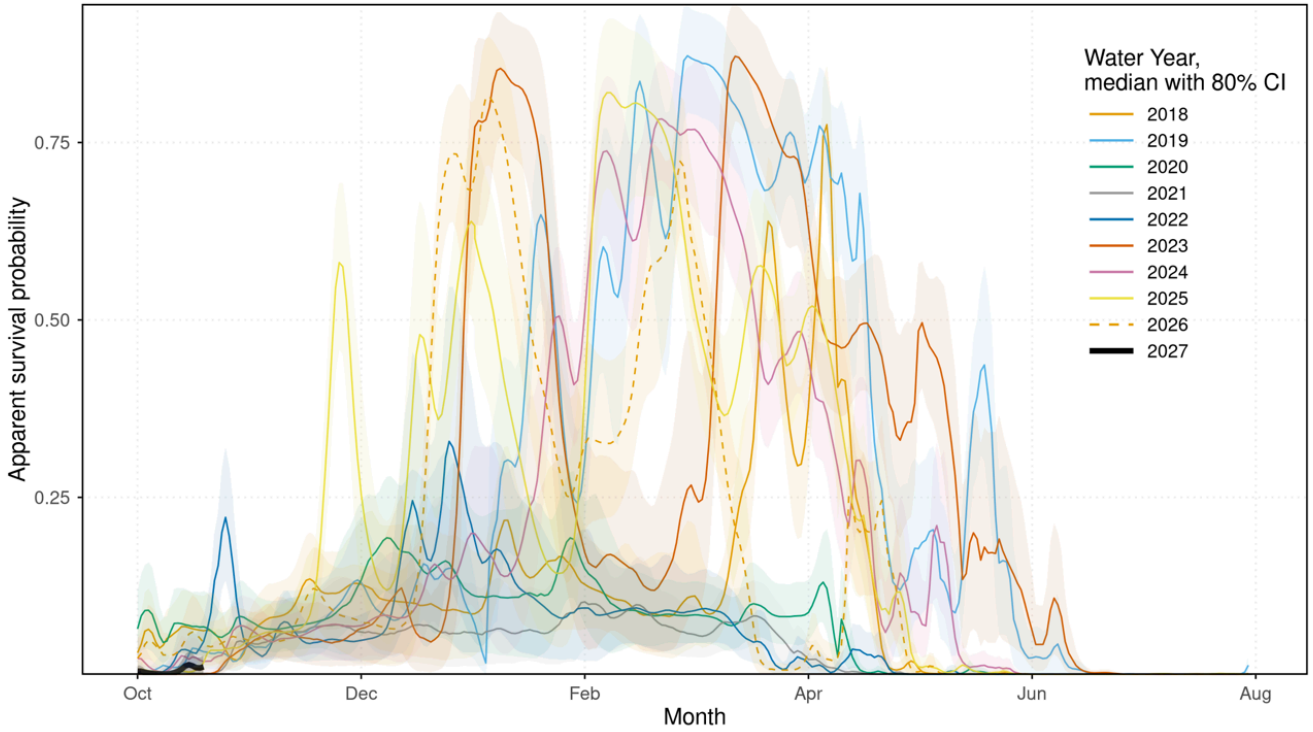
(Hance et al. 2022, Perry et al. 2018)

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- Adults in Ocean ▶
- Adults in River ▶


Interior Delta Route-specific Survival Probability: Median survival of daily cohorts using the Interior De

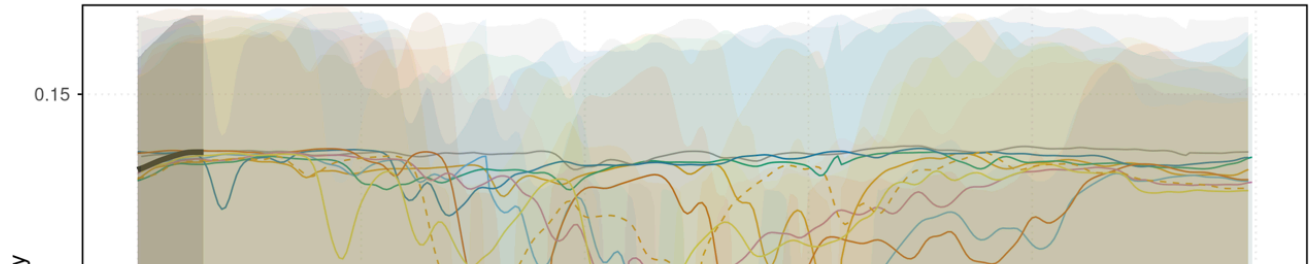
Delta STARS Model -
Predicted Natural Winter-run Chinook Daily Cohorts Passage, Knights Landing to Chipps Island




Data source: Delta STARS developed by USGS Quantitative Fisheries Ecology Section and deployed by SacPAS.
21 Oct 2026 09:11:04 PDT

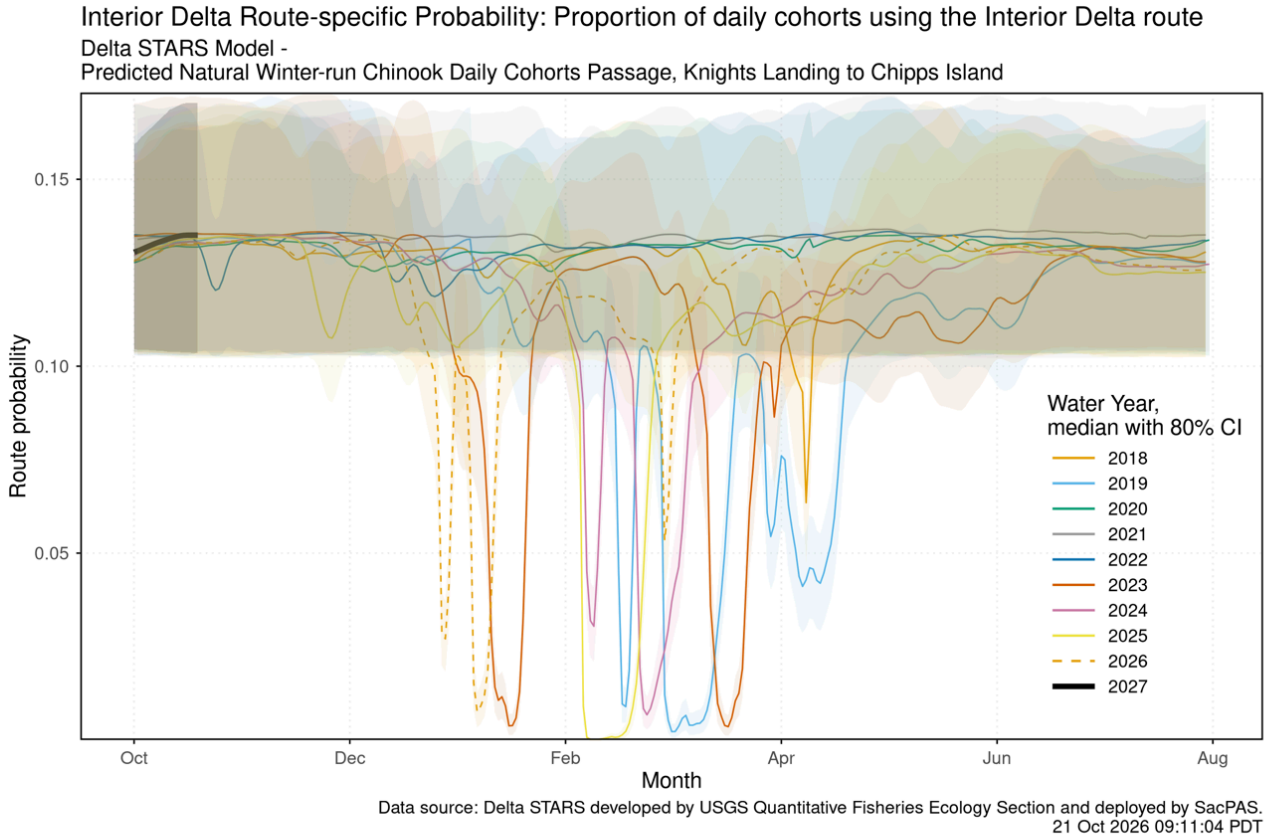
Interior Delta Route-specific Probability: Proportion of daily cohorts using the Interior Delta route

Delta STARS Model -
Predicted Natural Winter-run Chinook Daily Cohorts Passage, Knights Landing to Chipps Island



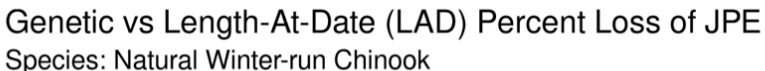
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- Adults in Ocean ▶
- Adults in River ▶




GitHub Repo | Interactive Plot | STARS ShinyApp

## Percent Loss of Juvenile Production Estimate (JPE)

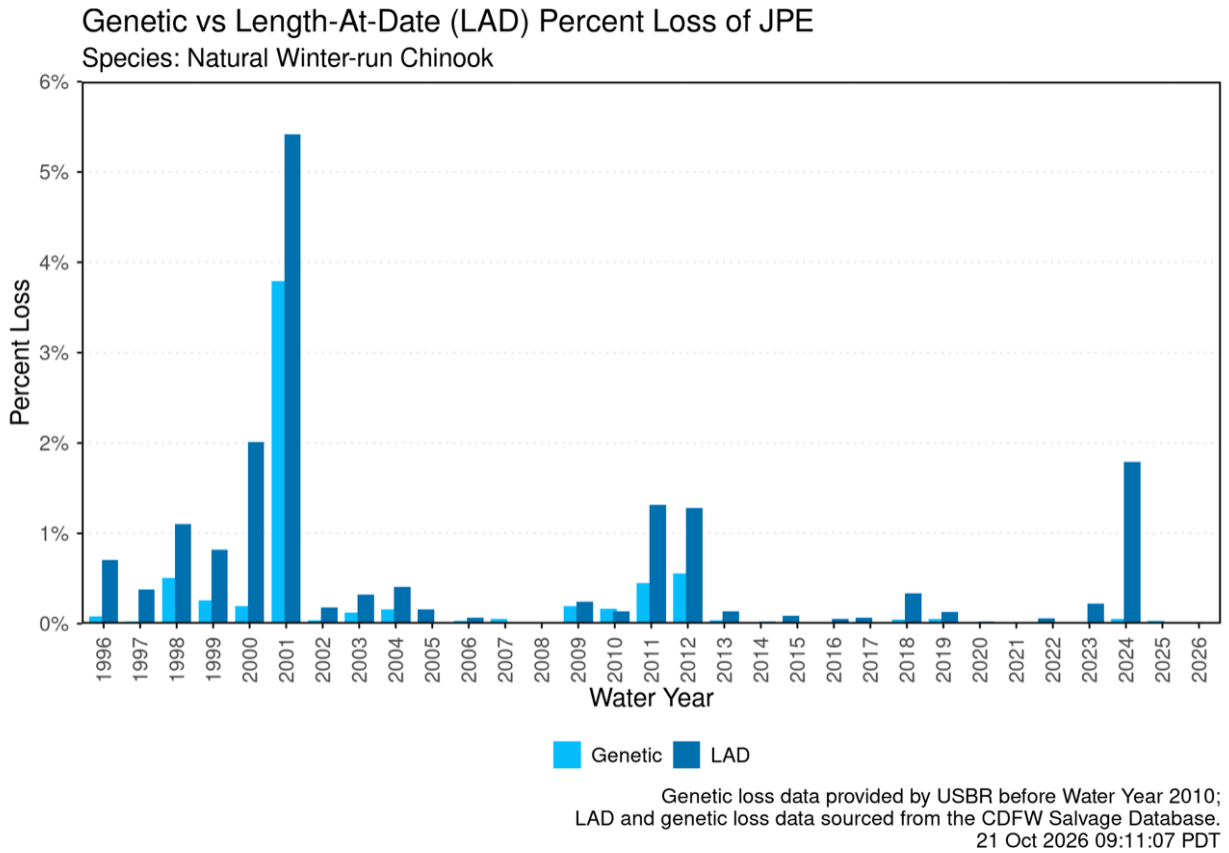


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Adults in Ocean ▶
Adults in River ▶

## Percent Loss of Juvenile Production Estimate (JPE)




**Genetic vs Length-at-Date (LAD) Historical Percent Loss of JPE**

GitHub Repo

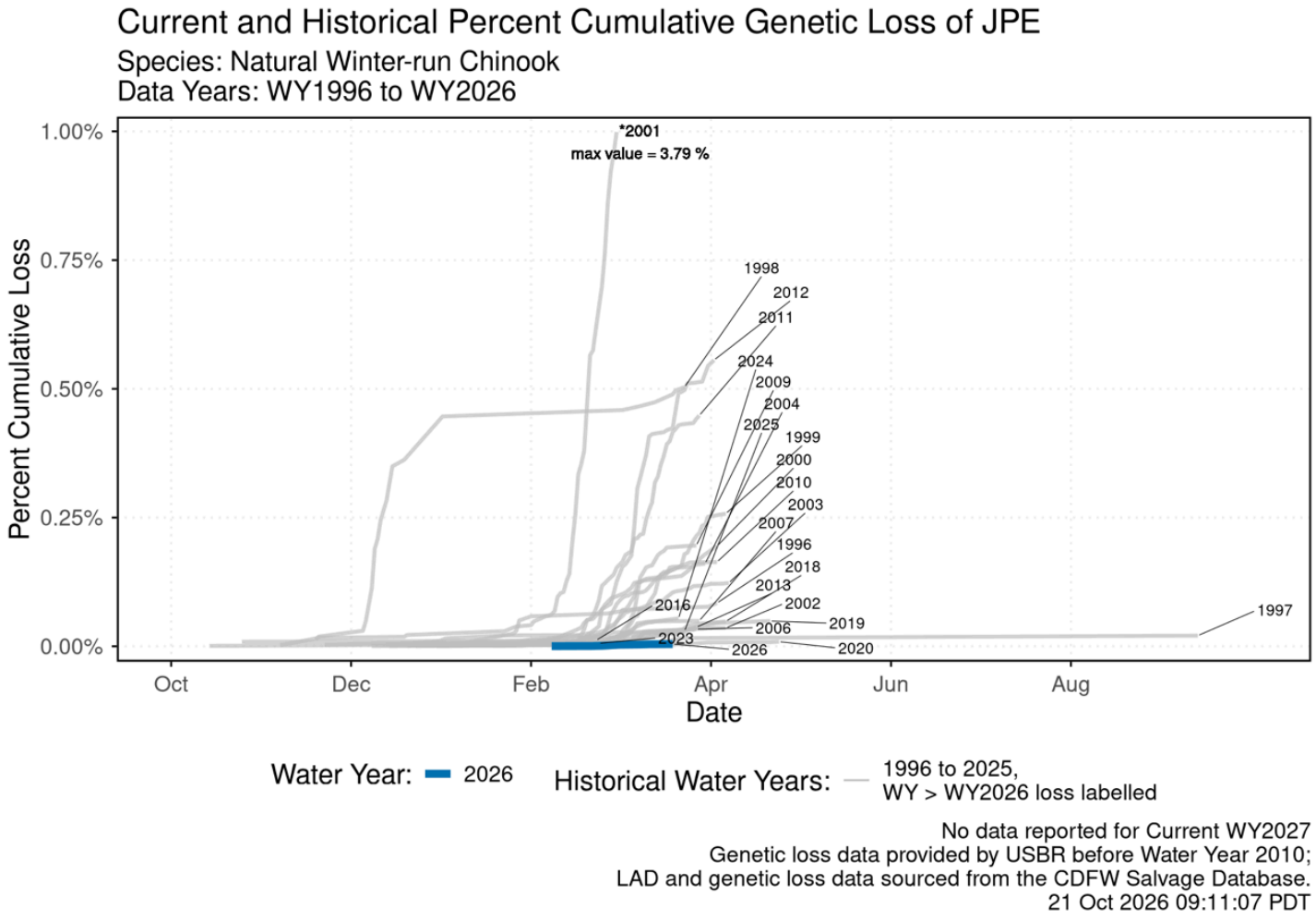
### Current and Historical Percent Cumulative Genetic Loss of JPE

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Adults in River ▶



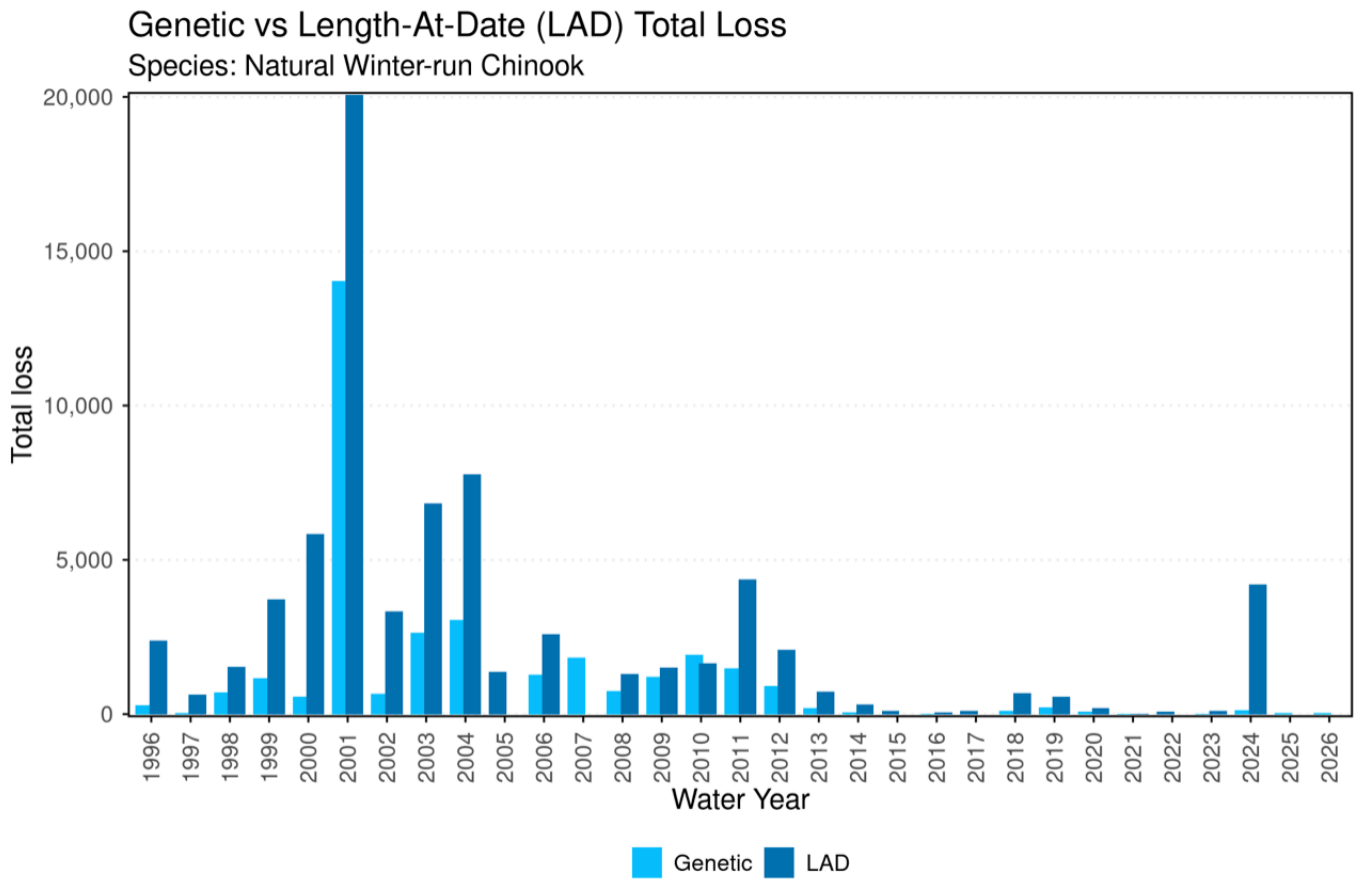

**Cumulative Genetic Percent Loss of JPE**

GitHub Repo

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## Loss

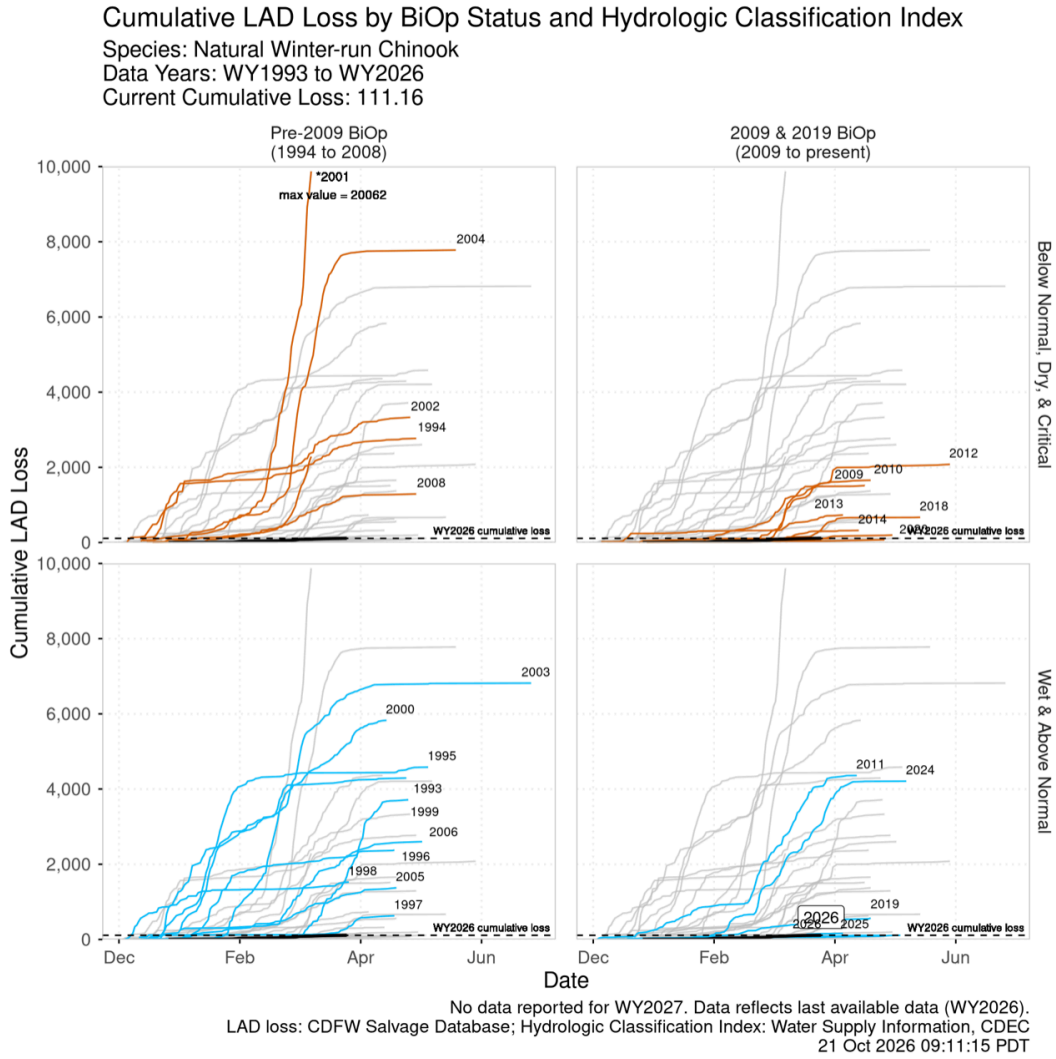



**Genetic vs Length-at-Date (LAD) Total Loss per water year**

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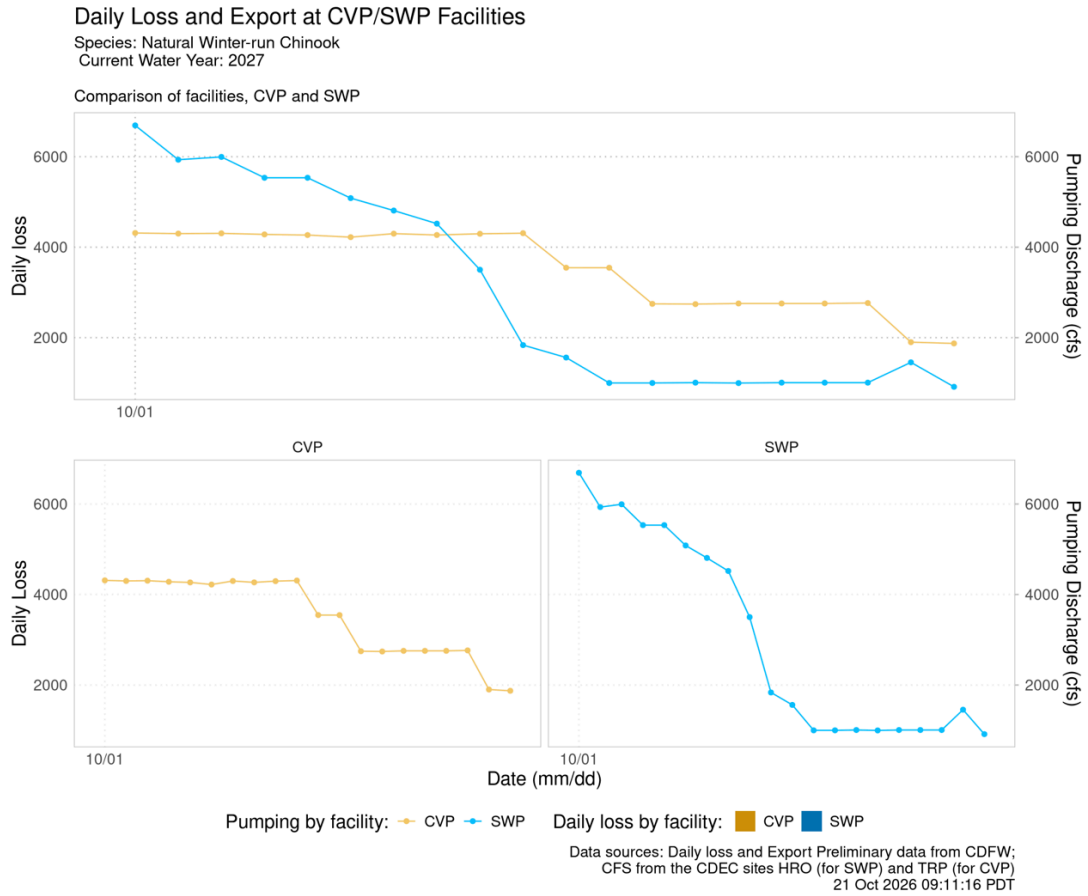

**The figure shows cumulative loss by BiOp Status and Hydrological Classification Index (HCI). Each quadrant of the faceted plot includes grey lines for historical years, colored lines (blue for wet years, red for dry years) for years within the BiOp status and HCI type, a black line for the current year, and a dashed horizontal line indicating the current cumulative loss maximum.**

GitHub Repo

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## Daily Loss and Export with OMR




**Daily LAD natural-origin winter-run Chinook salmon (CVP=gold bars and SWP=blue bars) with daily exports at both the CVP (gold line) and SWP (blue line). Vertical black bars are approximate dates when OMR/OMRI controlling factors change.**

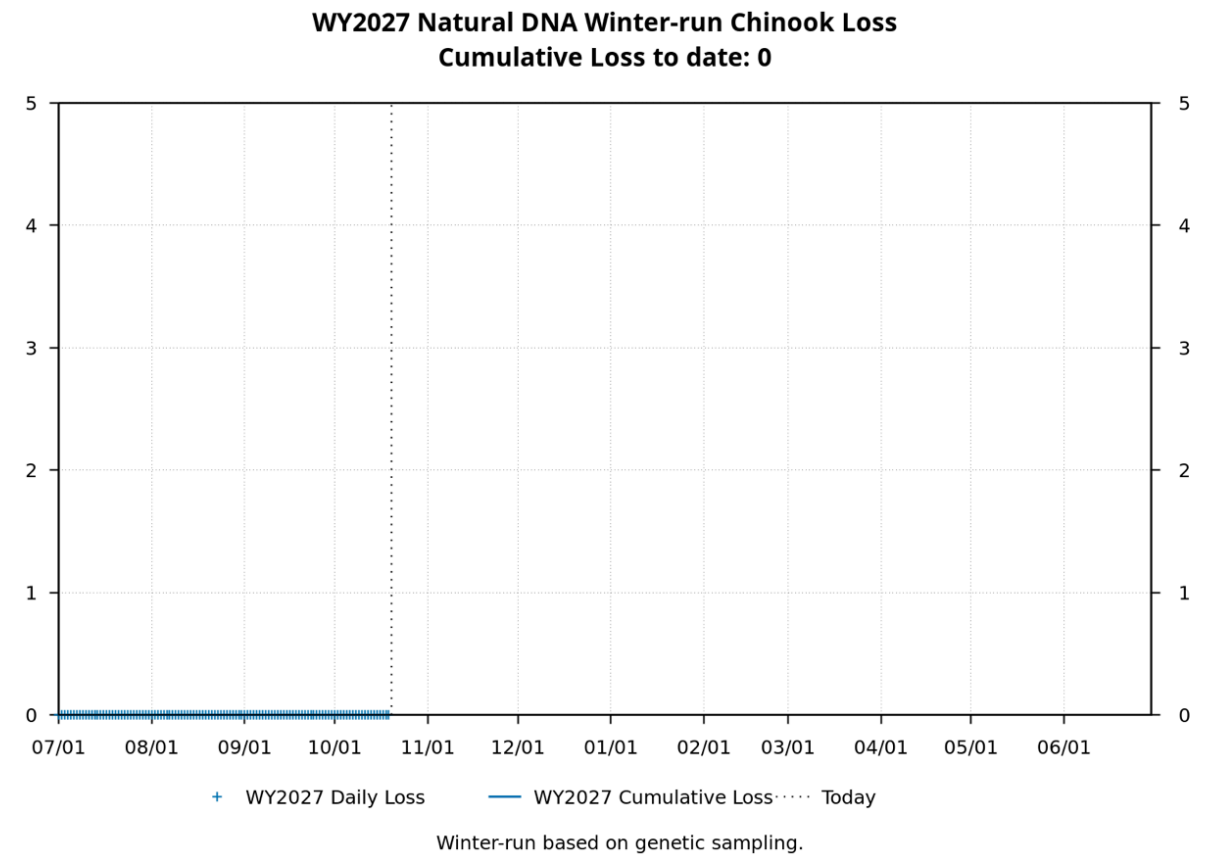
GitHub Repo | Interactive Plot | Related Query

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Adults in River ▶

## Loss Single Year Thresholds

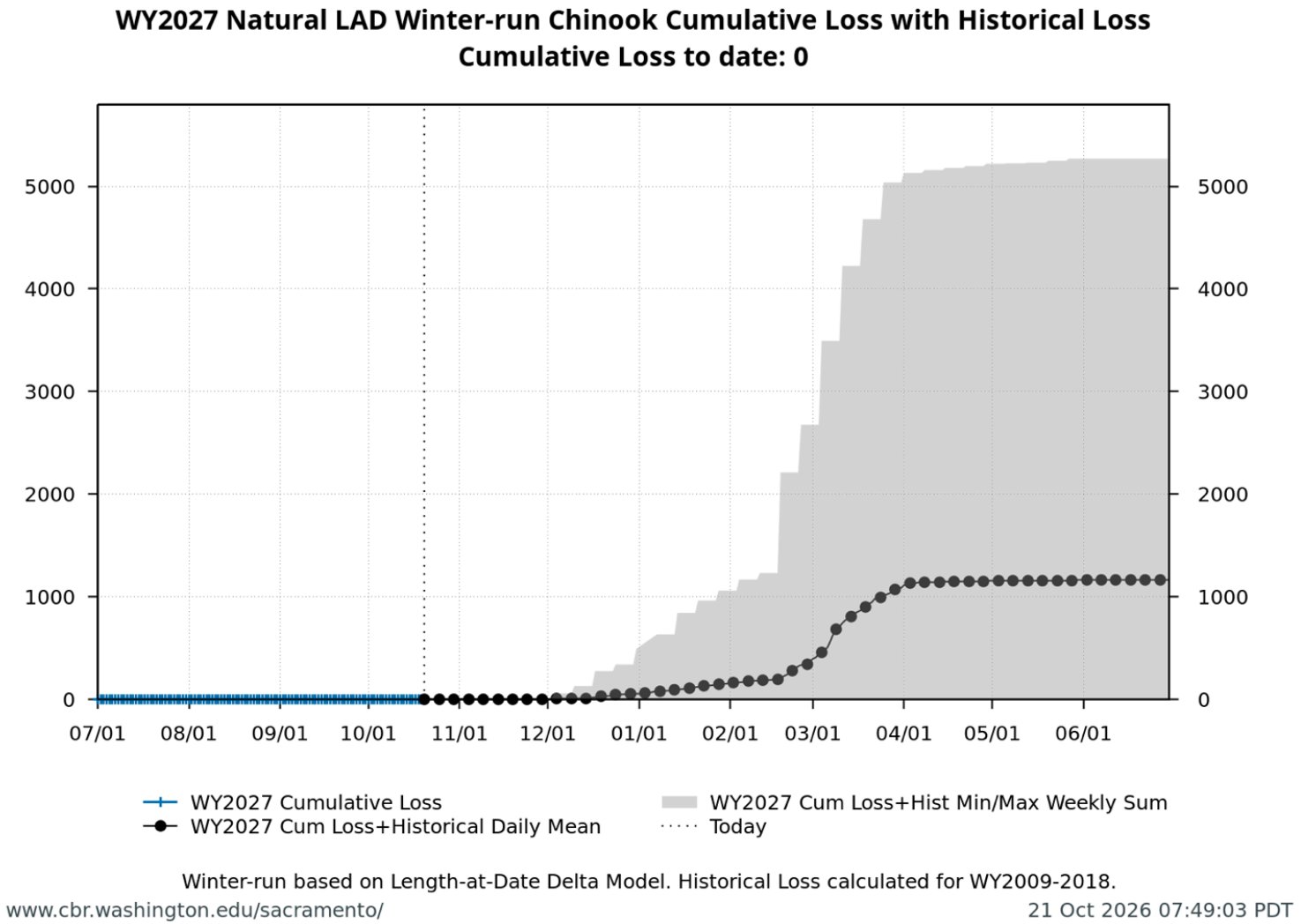
Included from Salmonids, Steelhead, and Current Conditions for the Delta Actions Team (DAT), Workgroups & Teams.




**Natural DNA Winter-Run Chinook Salmon Loss Cumulative to Date with Single Year Loss Thresholds**

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- Adults in River ▶

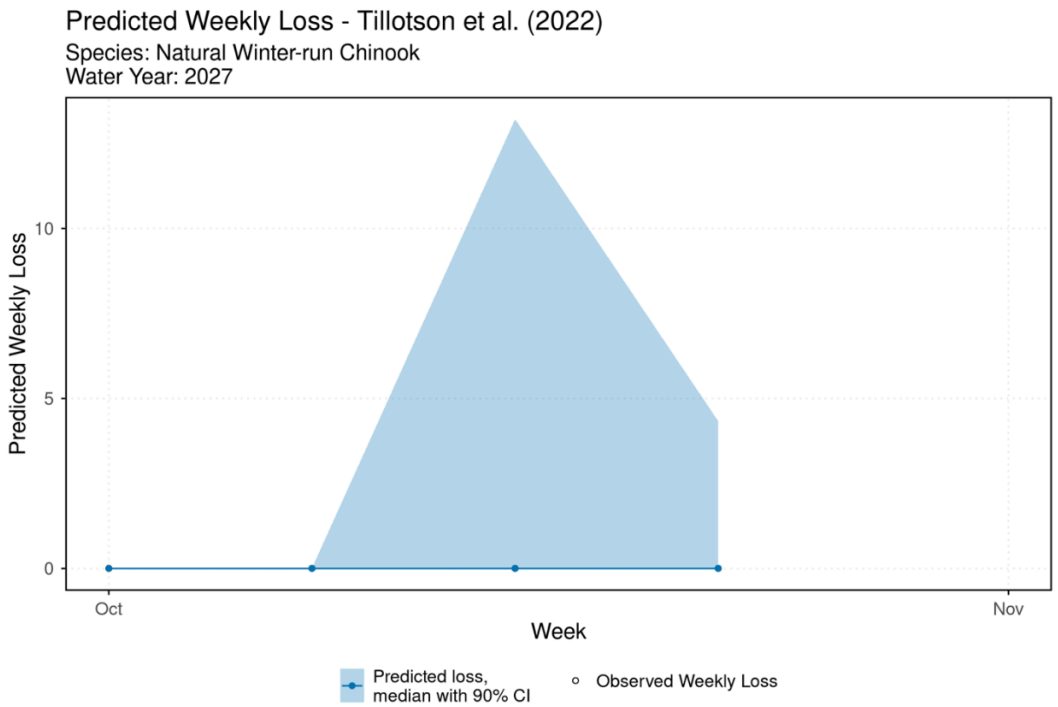



**Natural LAD Winter-Run Chinook Salmon Loss Cumulative to Date with WY2009-2018 history and Single Year Loss Thresholds**

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- Adults in River

## Predicted Weekly Loss




**Predicted and Observed Weekly Loss — Tillotson Model**

The model is rerun with the addition of near-real-time data for new predictions as the season progresses. With each model run, the values for the historical estimates and confidence intervals are not identical due to randomization in the `randomForest` R function, but are statistically equivalent.

**Table of Tillotson et al., (2022) model output of predicted weekly losses for Natural-origin Winter-run Chinook with model weekly average inputs including observed loss, Old and Middle Rivers (OMR), USGS tidally filtered flow (CFS), combined exports from CVP and SWP facilities (CFS), flow at Sacramento and San Joaquin (CFS), and water temperature at Mallard Island (°C).**

| WY week | Date | Median weekly predicted loss [lower CI, upper CI] | Observed Data | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Observed loss | OMR USGS tidally filtered (CFS) | Export, SWP & CVP (CFS) | Avg flow at Sacramento (CFS) | Avg flow at San Joaquin (CFS) | Avg water temperature at Mallard Island (°C) |

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**Table of Tillotson et al., (2022) model output of predicted weekly losses for Natural-origin Winter-run Chinook with model weekly average inputs including observed loss, Old and Middle Rivers (OMR), USGS tidally filtered flow (CFS), combined exports from CVP and SWP facilities (CFS), flow at Sacramento and San Joaquin (CFS), and water temperature at Mallard Island (°C).**

| WY week | Date | Median weekly predicted loss [lower CI, upper CI] | Observed Data | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | Observed loss | OMR USGS tidally filtered (CFS) | Export, SWP & CVP (CFS) | Avg flow at Sacramento (CFS) | Avg flow at San Joaquin (CFS) | Avg water temperature at Mallard Island (°C) |
| 4 | 2026-10-22 | 0.0 [0.0, 4.3] | 0.0 | -1300.0 | 2082.0 | 5916.7 | 1036.1 | 18.0 |
| 3 | 2026-10-15 | 0.0 [0.0, 13.2] | 0.0 | -4025.7 | 3441.9 | 9098.8 | 1722.5 | 18.9 |
| 2 | 2026-10-08 | 0.0 [0.0, 0.0] | 0.0 | -6567.1 | 5695.7 | 11201.5 | 1132.8 | 19.9 |
| 1 | 2026-10-01 | 0.0 [0.0, 0.0] | 0.0 | -9860.0 | 9938.4 | 15102.9 | 1006.5 | 20.4 |

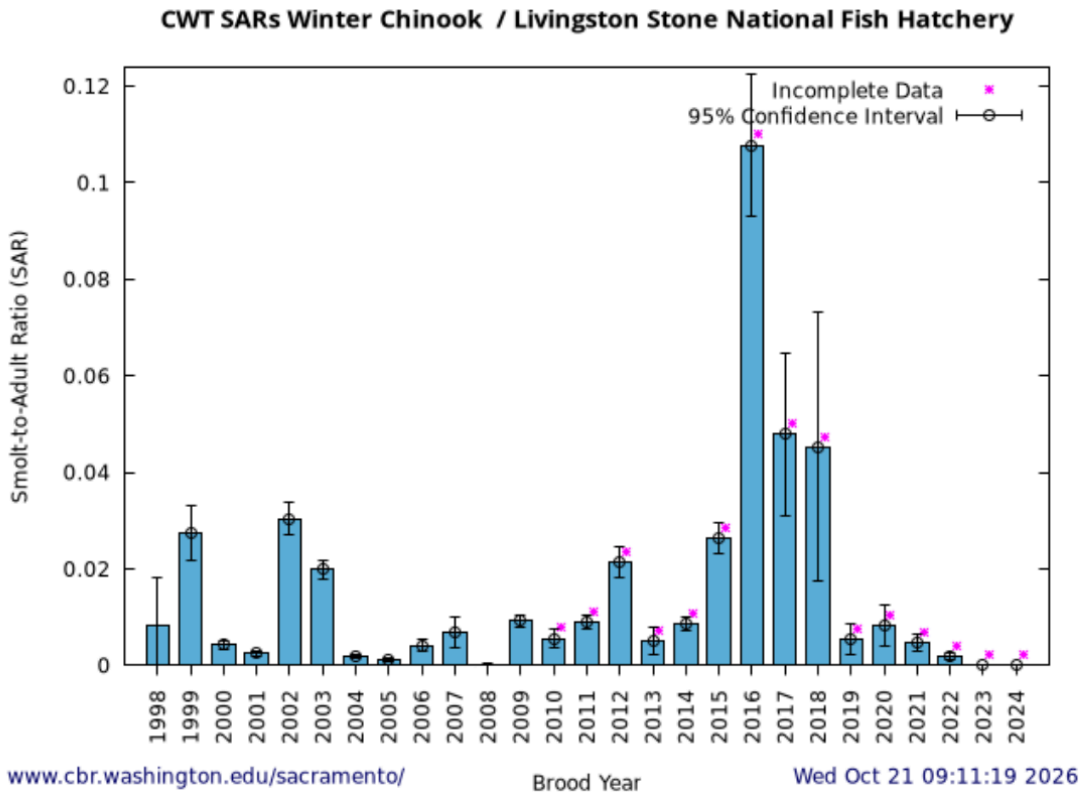
GitHub Repo | GitHub Repo: Tillotson model | GitHub Repo: Data and prediction | SacPAS Tool

ON THIS PAGE

- Juveniles in River
- Juveniles in Delta
- Adults in Ocean
  - CWT Smolt-to-Adult — annual data
  - PFMC Abundance, Harvest, Impact — annual data
- Adults in River

# Adults in Ocean

## CWT Smolt-to-Adult — annual data




Related Query

ON THIS PAGE

Juveniles in River
Juveniles in Delta
Adults in Ocean
CWT Smolt-to-Adult — annual data
PFMC Abundance, Harvest, Impact — annual data
Adults in River

# PFMC Abundance, Harvest, Impact — annual data

**Table II-2 Sacramento River winter Chinook abundance forecasts, allowable age-3 impact rates, and management performance (reproduced from PFMC 2026a)**

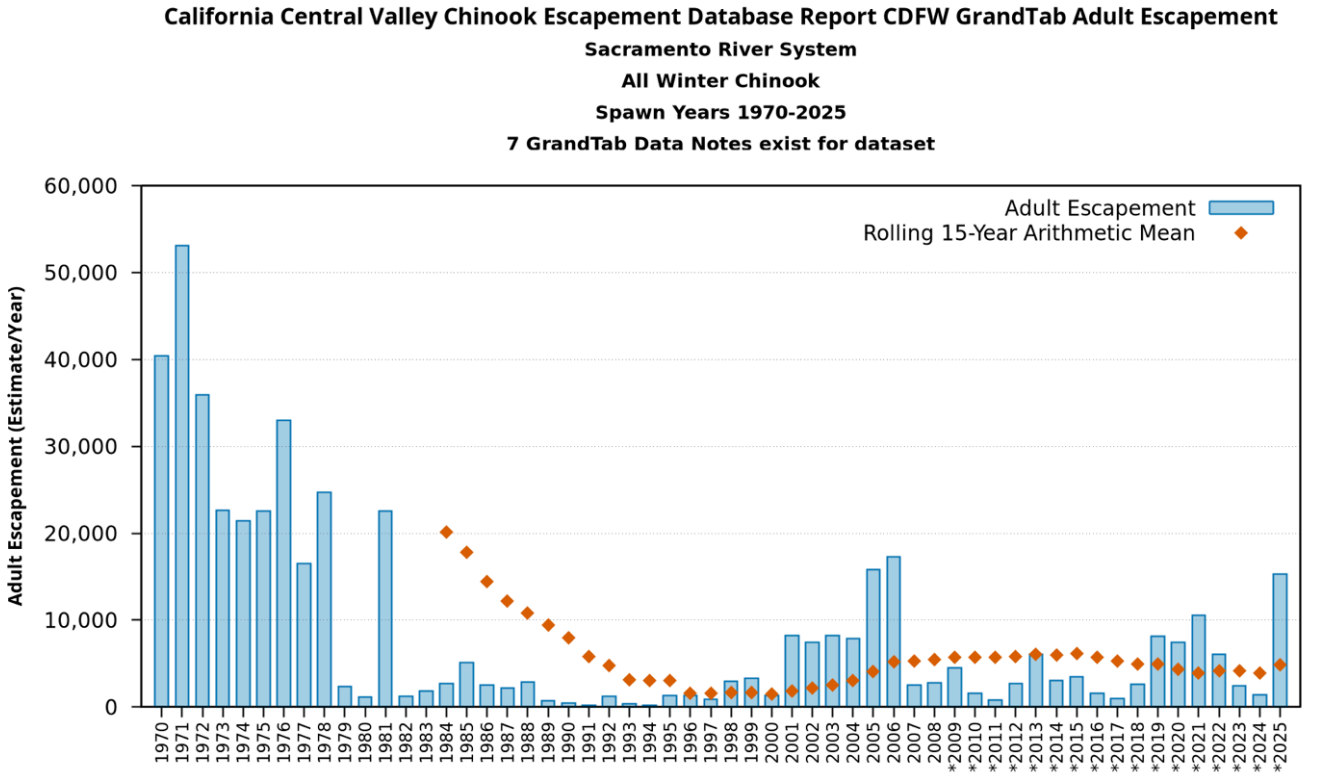
| Year [a] | 3-Year Geometric Mean [b] | Abundance Forecast [c] | Postseason Abundance [d] | Postseason Abundance Value Footnote | Age-3 impact rate south of Point Arena, CA | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Maximum Allowable (%) [e] | Preseason Forecast (%) | Postseason Estimate (%) | Postseason Estimate Value Footnote |
| **2026** [i] | | 9883 | | f | 20.0 | NA | NA | |
| **2025** | | 4507 | | f | 20.0 | 1.6 | NA | |
| **2024** | | 1013 | | f | 12.1 | — | — | |
| **2023** | | 4540 | | f | 20.0 | 0.0 | NA | h |
| **2022** | | 5971 | 3071 | | 20.0 | 15.2 | 26.2 | g |
| **2021** | | 9063 | 6346 | | 20.0 | 14.7 | 18.8 | |
| **2020** | | 3077 | 10854 | | 20.0 | 16.2 | 12.6 | |
| **2019** | | 1924 | 6935 | | 15.7 | 14.8 | 10.0 | |
| **2018** | | 1594 | 8139 | | 14.4 | 8.5 | 13.9 | |
| **2017** | 2521 | | 2117 | | 15.8 | 12.2 | 17.6 | |
| **2016** | 3981 | | 508 | | 19.9 | 12.8 | 10.7 | |
| **2015** | 3659 | | 867 | | 19.0 | 17.5 | | e |
| **2014** | 2380 | | 3718 | | 15.4 | 15.4 | 15.8 | |
| **2013** | 1521 | | 3067 | | 12.9 | 12.9 | 18.8 | |
| **2012** | 1797 | | 5960 | | 13.7 | 13.7 | 12.6 | |

ON THIS PAGE

- Juveniles in River
- Juveniles in Delta
- Adults in Ocean
- Adults in River
  - Adult Escapement — annual data

# Adults in River

## Adult Escapement — annual data




Data Source:
Azat, J. CDFW GrandTab.

https://www.calfish.org/ProgramsData/Species/CDFWAnadromousResourceAssessment.aspx

Monitoring period: varies
* Preliminary Data; 2025 incomplete.
www.cbr.washington.edu/sacramento/
21 Oct 2026 09:11:19 PDT

ON THIS PAGE

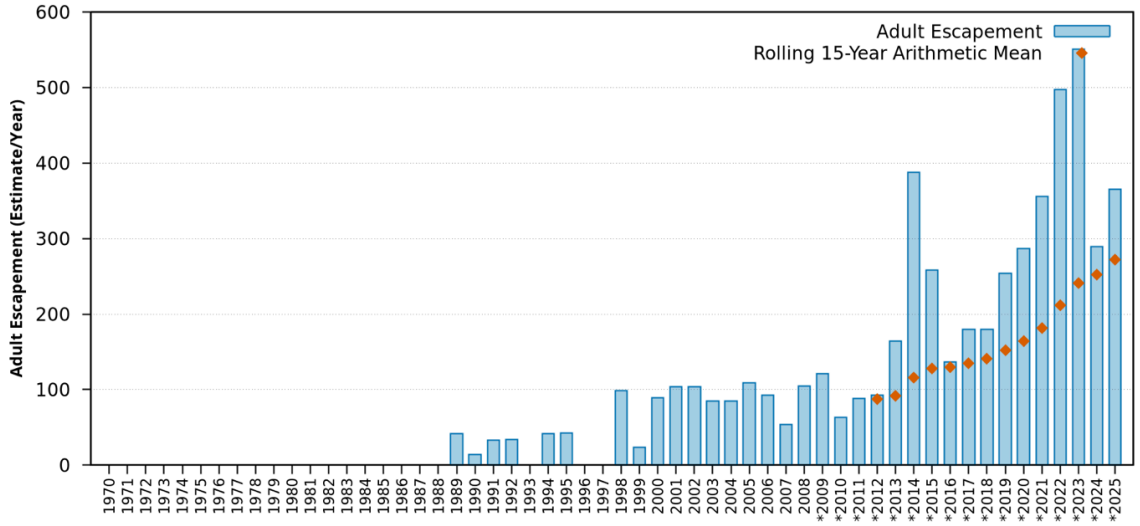
Juveniles in River ▶
Juveniles in Delta ▶
Adults in Ocean ▶
Adults in River ▼
Adult Escapement — annual data

Data Source:
Azat, J. CDFW GrandTab.

https://www.calfish.org/ProgramsData/Species/CDFWAnadromousResourceAssessment.aspx

Monitoring period: varies
* Preliminary Data; 2025 incomplete.
www.cbr.washington.edu/sacramento/
21 Oct 2026 09:11:20 PDT

**California Central Valley Chinook Escapement Database Report CDFW GrandTab Adult Escapement**
**Sacramento River System**
**All Hatchery Winter Chinook**
**Spawn Years 1970-2025**
**3 GrandTab Data Notes exist for dataset**



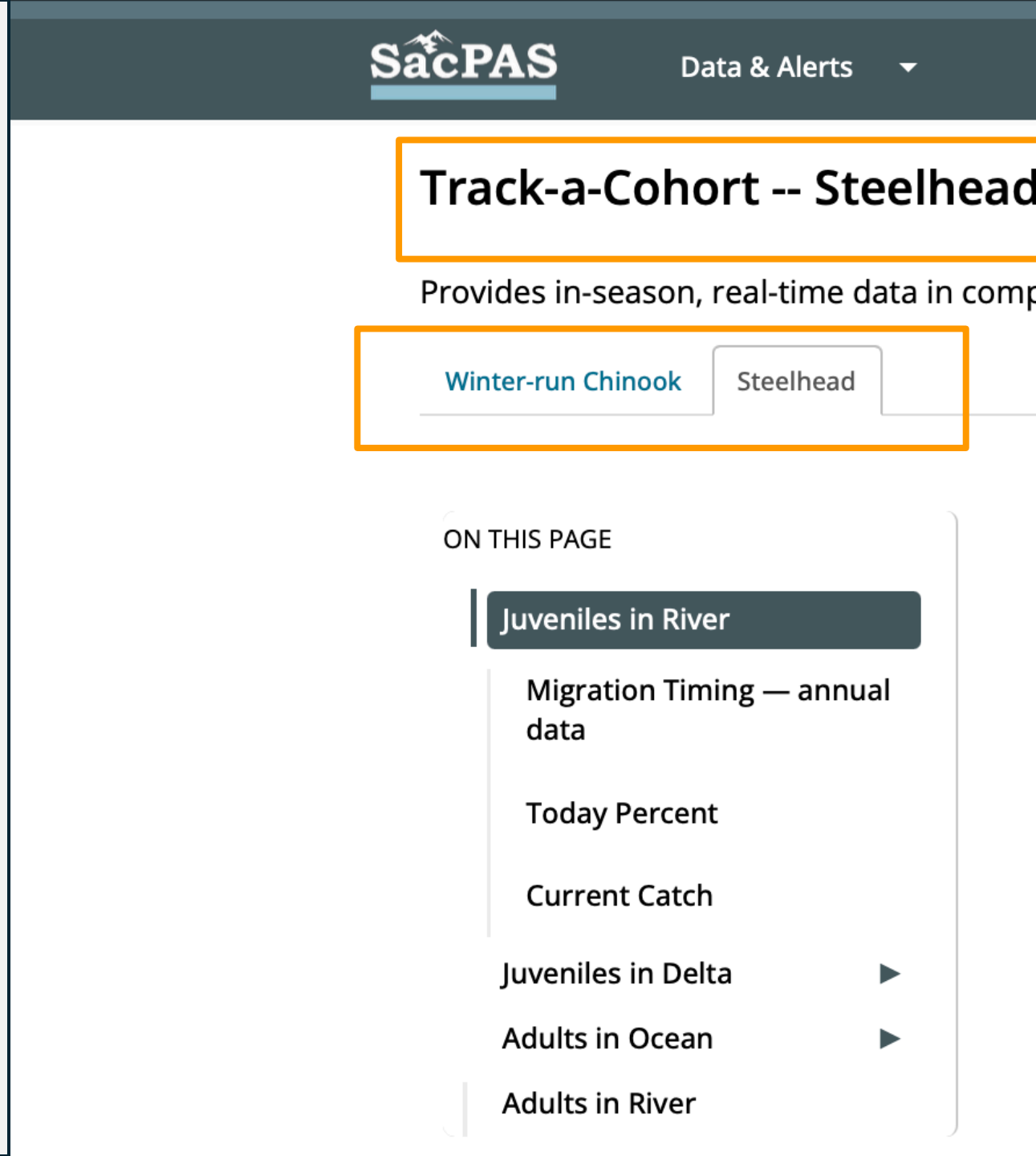

Data Source:
Azat, J. CDFW GrandTab.

https://www.calfish.org/ProgramsData/Species/CDFWAnadromousResourceAssessment.aspx

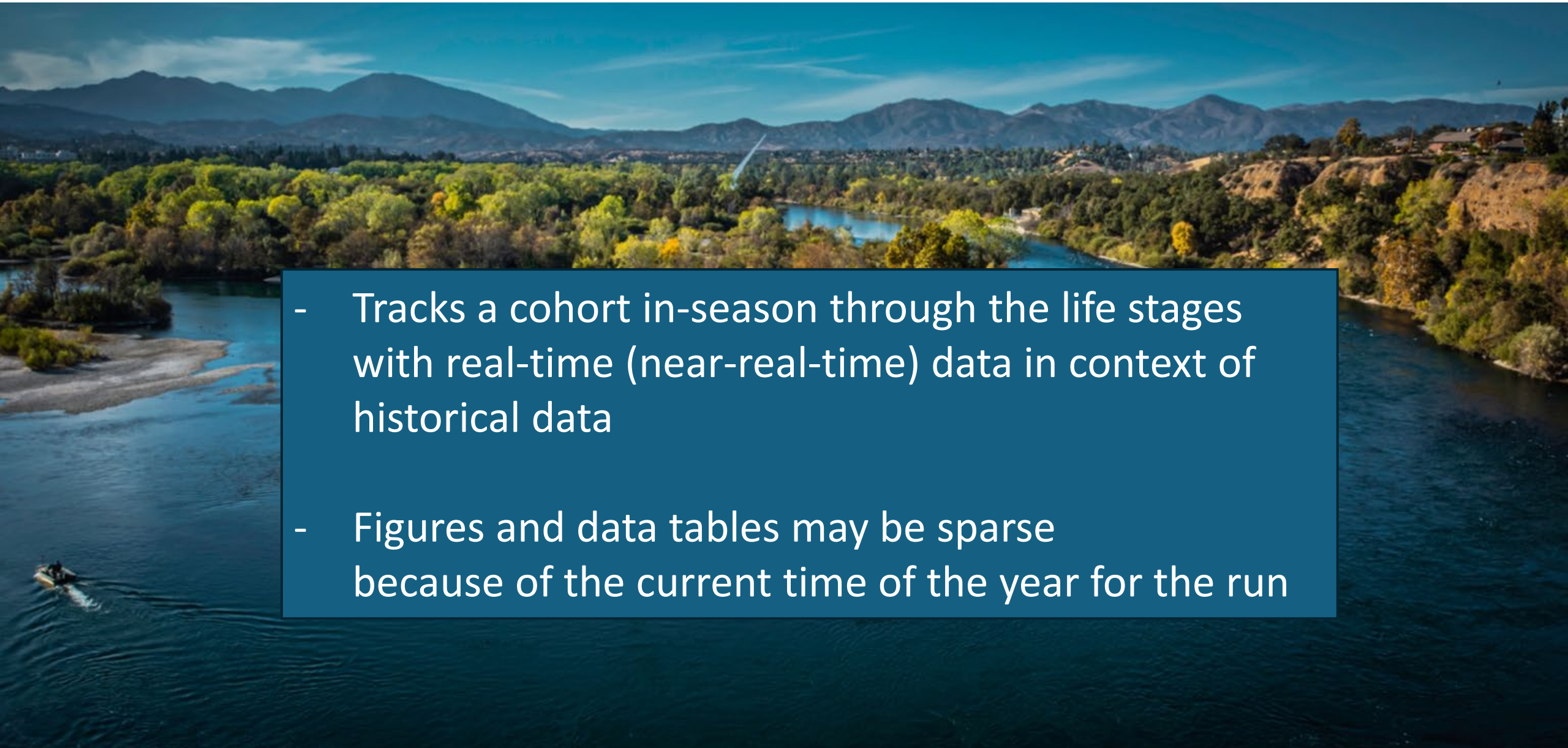
Monitoring period: varies
* Preliminary Data; 2025 incomplete.
www.cbr.washington.edu/sacramento/
21 Oct 2026 09:11:20 PDT

Related Query

Also available for Sacramento River Steelhead



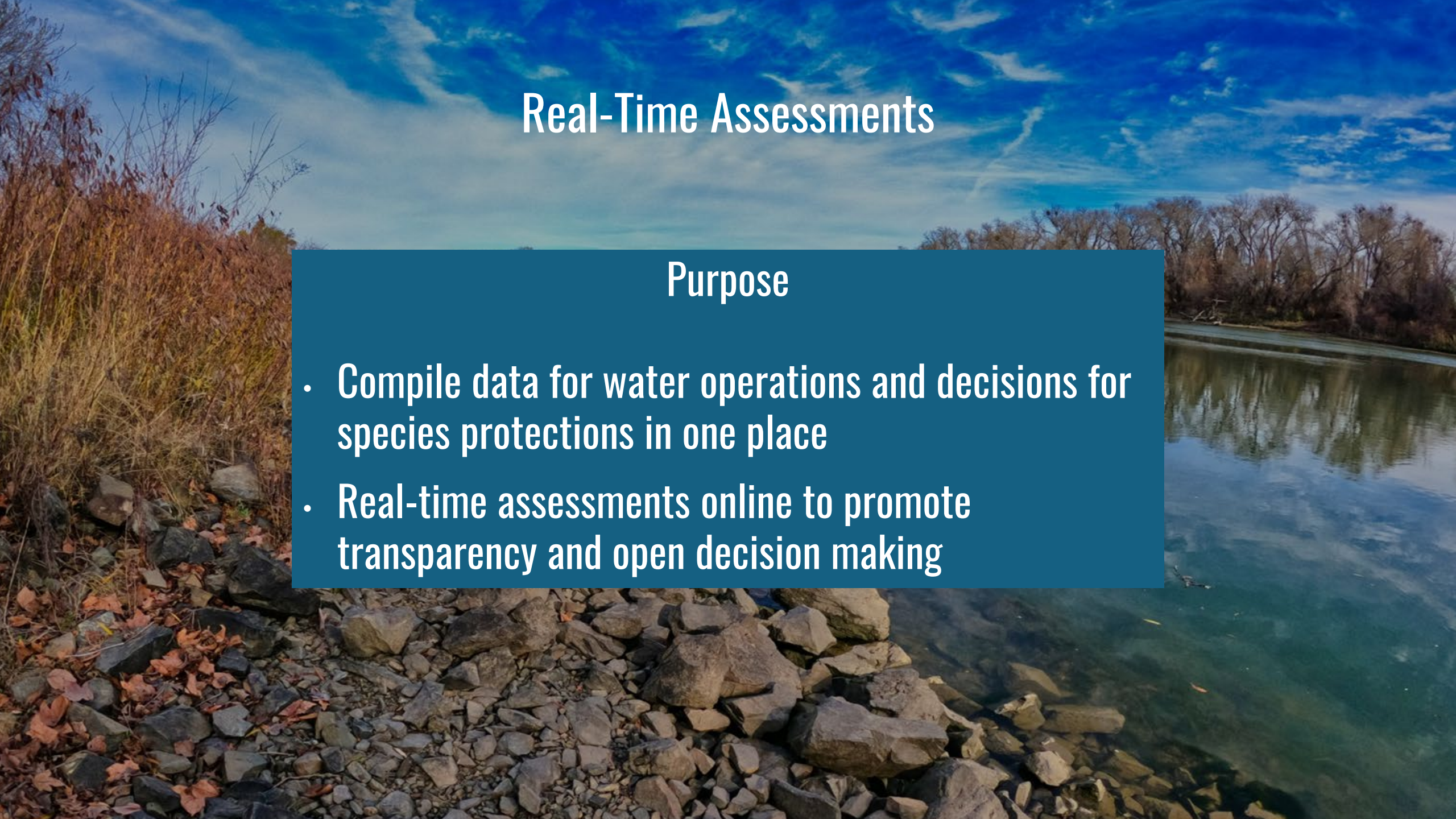
# Track-a-Cohort



- Tracks a cohort in-season through the life stages with real-time (near-real-time) data in context of historical data

- Figures and data tables may be sparse because of the current time of the year for the run


Real-Time Assessments



# Real-Time Assessments

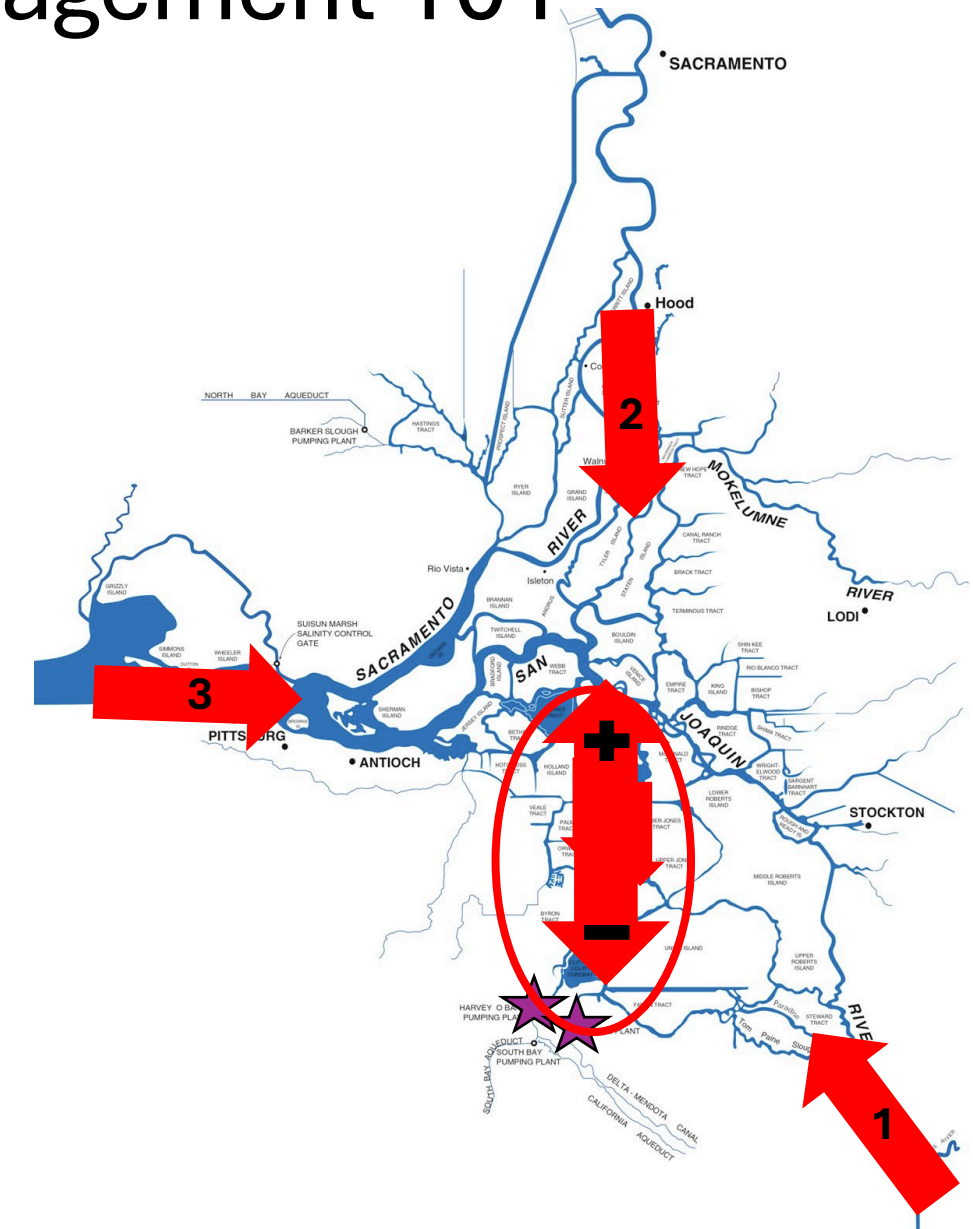
## Purpose

- Compile data for water operations and decisions for species protections in one place
- Real-time assessments online to promote transparency and open decision making

# Old and Middle River (OMR) Management 101

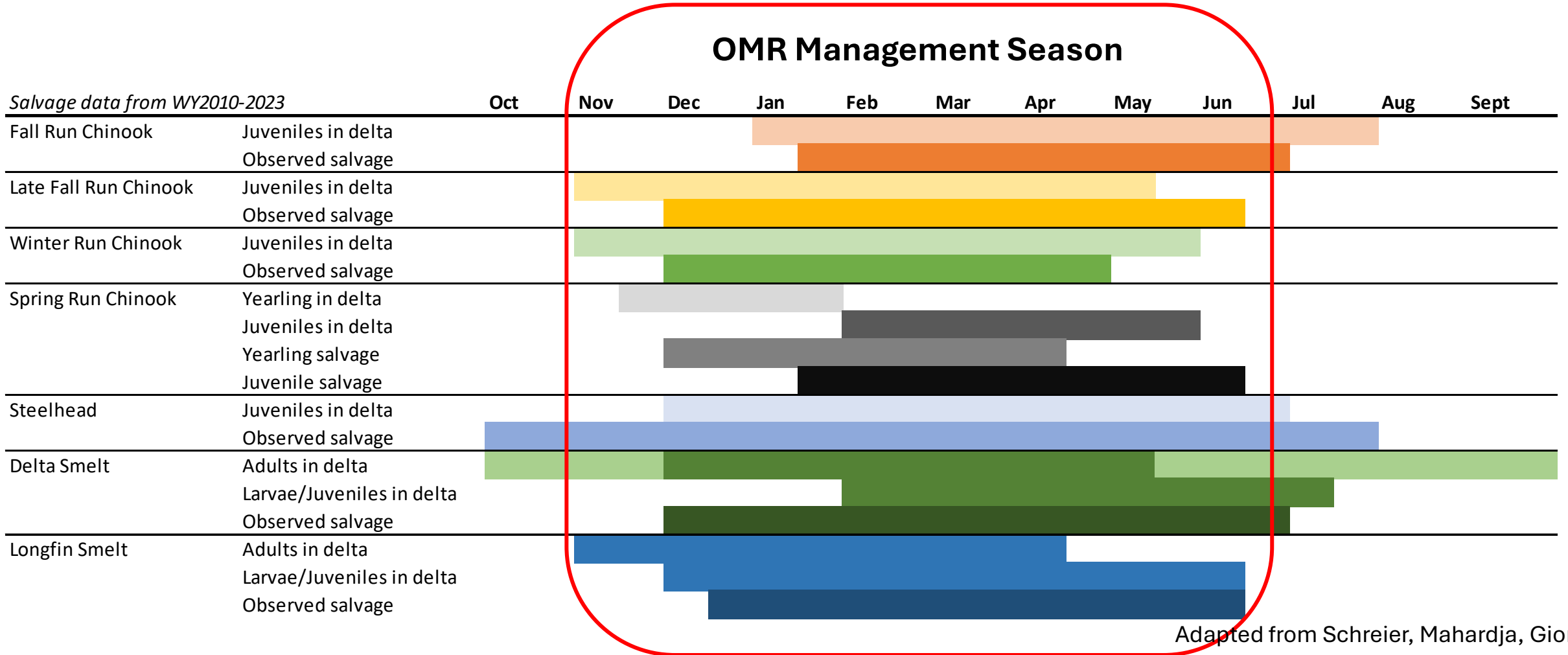
- Old and Middle River Index (OMRI) provides a surrogate indicator of how exports influence hydrodynamics in the south Delta

- OMR Entrainment Management season is designed to reduce entrainment of fish in the southern Delta, or salvage at the facilities



# Old and Middle River (OMR) Management 101

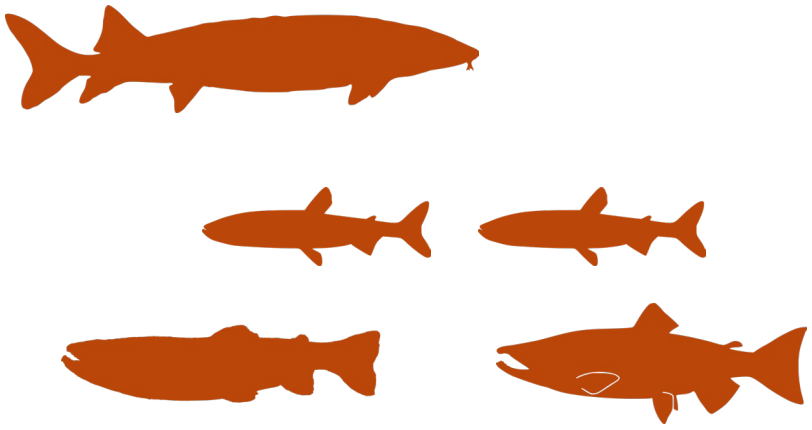
- Season is October – June

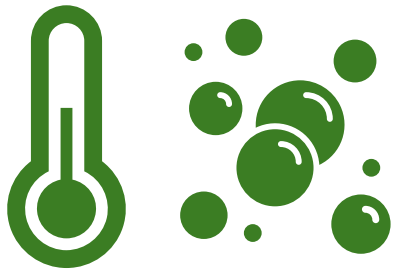



Adapted from Schreier, Mahardja, Giorgi

# Assessments provide information on listed species

- During Old and Middle River (OMR) season, weekly assessments compile data on:
  - Fish presence and movement
  - Salvage and loss history
  - Likelihood of fish presence in the interior Delta (using flows and environmental surrogates)
  - Operations

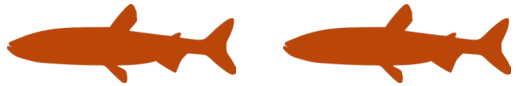






# Data required for assessments: Osmerids

- Abundance of different life stages
- Supplementation releases (Delta smelt)
- Salvage and loss



- South Delta turbidity
- Water temperature



- Particle Tracking Models
- Flows (JPF)



- **Longfin Smelt Adults**: If JPF is < 0 cfs, an assessment indicates annual loss is on a trajectory to exceed 5% of the adult population abundance, and reduced exports will reduce entrainment into the South Delta, Reclamation and DWR would reduce CVP and SWP exports to maintain an average OMRI no more negative than -3,500 cfs for at least 7 days and prepare a subsequent assessment.
- **Longfin Smelt Larvae and Juveniles**: If JPF is < 0 cfs and a population model demonstrates a need to reduce entrainment to avoid population decline, Reclamation and DWR would reduce average OMRI no more negative than -3,500 cfs for at least 7 days and prepare a subsequent assessment.
- **Delta Smelt Adults**: If JPF is < 0 cfs, daily average turbidity is ≥ 12 FNU in the OMR corridor, and average water temperatures at Jersey Point or Rio Vista have not exceeded 53.6°F (12°C) consecutively for 3 days, Reclamation and DWR would make a one-time action to reduce reducing CVP and SWP exports to maintain an average OMRI no more negative than -3,500 cfs for at least 7 days.
- **Delta Smelt Larvae and Juveniles**: After the onset of spawning, if JPF is < 0 cfs, turbidity is ≥ 12 FNU in the south Delta, and PTM modeling indicates that the action would avoid ≥ 5% entrainment of the Delta smelt population at facilities after 30 days, Reclamation and DWR would reduce CVP and SWP exports to maintain an average OMRI no more negative than -3,500 cfs for at least 7 days and prepare a subsequent assessment.

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## Workgroups & Teams

*Customized data visualizations, biological thresholds, and data tables of current conditions with recent and real-time data to facilitate in-season monitoring and management by Central Valley Workgroups and Monitoring Teams.*

RESOURCES

Water Operations and Watershed Monitoring Technical Teams, BDO, BOR

DELTA ACTIONS TEAM

Real-time Assessments

Track-a-Cohort

PA 3.3.3 Winter Chinook

Chinook and Steelhead

Delta Smelt and Longfin Smelt

more DAT

STANISLAUS WATERSHED TEAM

Temperature and Flow

Current River Conditions

Water Temperature Hist. & Current

more SWT

SACRAMENTO RIVER TECHNICAL GROUP

Fall Flow Redd Dewatering

SAN JOAQUIN R RESTORATION PROGRAM

Allocation Management

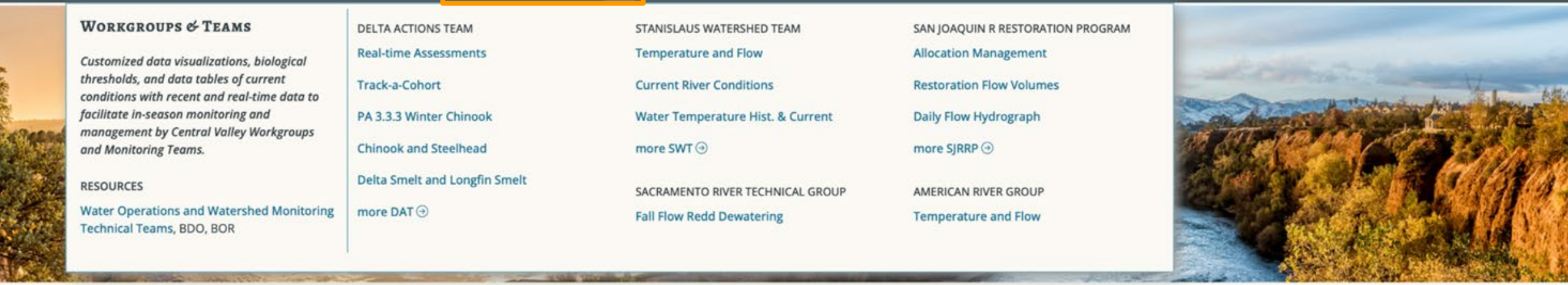
Restoration Flow Volumes

Daily Flow Hydrograph

more SJRRP

AMERICAN RIVER GROUP

Temperature and Flow



## Access

Data and decision support tools on fishes and environmental conditions

## Research

Fish survival and migration models, presentations, and publications

## Connections

Collaborators, practitioners, stakeholders, students, knowledge, and experiences






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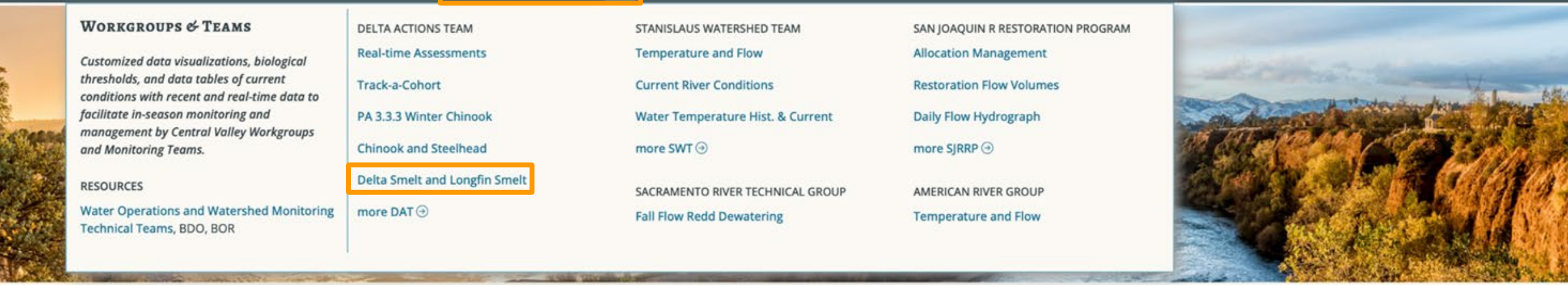
Restoration Flow Volumes

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AMERICAN RIVER GROUP

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# Delta Smelt, Longfin Smelt, and Current Conditions for the Delta Actions Team (DAT)

ON THIS PAGE

- Daily Conditions for Last 2 Weeks
- Delta Smelt Releases
- Summary Tables
- Figures
- Water Year Tables
- Hourly Table
- Data Notes & Resources

Downloads: download Daily CSV download Hourly CSV

## Daily Conditions for Last 2 Weeks

download Daily CSV (all parameters)

### Operational Indices Daily Data for Last 2 Weeks for select locations and parameters

| Date | QWEST (CFS) [DWR] | QWEST 7-day (CFS) [DWR] | JPF (CFS) [DWR] | X2 Position (KM) [DWR] | OMR Index (CFS) [SacPAS] | OMR Index 5-day (CFS) [SacPAS] | OMR Index 14-day (CFS) [SacPAS] | USGS Tidally Filtered OMR (CFS) [USGS] | USGS Tidally Filtered OMR 5-day mean (CFS) [USGS] | USGS Tidally Filtered OMR 14-day mean (CFS) [USGS] | NDOI (CFS) [DWR] | NDOI 3-day (CFS) [DWR] | E/I Ratio 3 day (%) [DWR] | Sum Pumping Discharge HRO+TRP (CFS) [CDEC:HRO+TRP] | Pumping Discharge Harvey O Banks Pumping Plant (CFS) [CDEC:HRO] | Pur Dis SJR Pur Pla [CD |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2026-10-14 | 1617 | -857 | 1742 | 82 | -3490 | -4400 | -7400 | -4790 | -5480 | -8214 | 6179 | 6480 | 31.5 | 3746 | 1005.00 | |
| 2026-10-15 | 1737 | 200 | 1865 | 82 | -3574 | -3919 | -6906 | -4690 | -4926 | -7779 | 6031 | 6356 | 30.4 | 3751 | 996.00 | |
| 2026-10-16 | 1745 | 1095 | 1886 | 82 | -3637 | -3692 | -6461 | -4570 | -4692 | -7341 | 5618 | 5943 | 31.5 | 3760 | 1005.00 | |
| 2026-10-17 | 1716 | 1541 | 1858 | | -3549 | -3548 | -6013 | -4290 | -4586 | -6921 | 5253 | 5634 | 32.4 | 3760 | 1005.00 | |
| 2026-10-18 | 2013 | 1689 | 2164 | | -3325 | -3515 | -5586 | -4270 | -4522 | -6548 | 5399 | 5423 | 33.1 | 3770 | 1005.00 | |

ON THIS PAGE


- Daily Conditions for Last 2 Weeks
- Delta Smelt Releases
- Summary Tables ▶
- Figures ▶
- Water Year Tables ▶
- Hourly Table
- Data Notes & Resources


## Water Quality Daily Data for Last 2 Weeks for select locations and parameters

| Date | River Discharge Flow 3-day Freeport (CFS) [CDEC:FPT] | River Discharge Flow SJR nr Vernalis (CFS) [CDEC:VNS] | Rio Vista Flow (CFS) [DWR] | Water Temperature 3-day Jersey Point (C) [CDEC:SJW] | Water Temperature 3-day SR at Rio Vista Br (C) [CDEC:RVB] | Water Temperature Clifton Court (C) [CDEC:CLC] | Water Temperature SJR at Antioch (C) [CDEC:ANH] | Turbidity 3-day Freeport (FNU) [CDEC:FPT] | Water Turbidity 1-day Old River at Bacon Island (USGS) (FNU) [CDEC:OBI] | Water Turbidity 1-day Old River at Franks Tract (FNU) [CDEC:OSJ] | Water Turbidity 1-day SJR Holland Cut (FNU) [CDEC:HOL] |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2026-10-14 | 10484.67 | 1087.28 | 4765 | 20.11 | 19.17 | 20.20 | 19.44 | 2.59 | 1.08 | 3.13 | 0.95 |
| 2026-10-15 | 10217.67 | 926.08 | 4496 | 19.88 | 18.87 | 20.10 | 19.44 | 2.52 | 1.17 | 2.40 | 0.90 |
| 2026-10-16 | 9760.00 | 1131.42 | 4089 | 19.81 | 18.78 | 20.10 | 19.56 | 2.44 | 0.87 | 1.67 | 0.84 |
| 2026-10-17 | 9096.00 | 1651.28 | 3739 | 19.86 | 18.80 | 20.10 | 19.56 | 2.36 | 0.93 | 1.63 | 0.88 |
| 2026-10-18 | 8606.67 | 2207.96 | 3576 | 19.93 | 18.80 | 20.20 | 19.44 | 2.40 | 0.88 | 1.62 | 1.01 |
| 2026-10-19 | 8764.00 | 2449.72 | 3367 | 19.82 | 18.65 | 19.30 | 19.00 | 2.43 | 0.88 | 1.68 | 0.84 |
| 2026-10-20 | 9119.00 | 2081.54 | 3524 | 19.59 | 18.39 | 18.90 | 18.78 | 2.46 | 0.97 | 1.52 | 0.87 |
| 2026-10-21 | 9308.67 | 1629.28 | 3717 | 19.30 | 18.09 | 18.90 | 18.61 | 2.35 | 1.18 | 1.61 | 1.01 |
| 2026- | 9195.00 | 1372.29 | 3466 | 19.08 | 17.85 | 18.70 | 18.44 | 2.31 | 1.29 | 2.13 | 1.20 |

# Delta Smelt Releases

ON THIS PAGE

- Daily Conditions for Last 2 Weeks
- Delta Smelt Releases
- Summary Tables
- Figures
- Water Year Tables
- Hourly Table
- Data Notes & Resources

Delta Smelt releases reported to SacPAS for WY2026

| Date | Location | ~Days post hatch | Release Method | Adipose Fin Clipped | VIE Tagged | VIE Color and Position | Total Released | Description |
|---|---|---|---|---|---|---|---|---|
| 2026-06-02 | Sacramento River at Sherman Island | 120 | Fish Transport tank | 0% | 0% | | 4000 | On 2026-06-02, the USFWS will truck approximately ~4000 brood year 2026 Delta Smelt from the FC&CL to Sacramento River at Sherman Island for release into the Delta. This release will include 0% Adipose fin clipped individuals and 0% Visible Implant Elastomer tagged individuals. |
| 2026-04-03 | Sacramento River at Sherman Island | 40 | Plastic bags | 0% | 0% | | 8142 | On 2026-04-03, the USFWS will truck approximately ~8142 brood year 2026 Delta Smelt from the FC&CL to Sacramento River at Sherman Island for release into the Delta. This release will include 0% Adipose fin clipped individuals and 0% Visible Implant Elastomer tagged individuals. |
| | Sacramento | | | | | | | On 2026-04-01, the USFWS will truck approximately ~34796 brood year 2026 Delta Smelt from the FC&CL to Sacramento |

ON THIS PAGE


- Daily Conditions for Last 2 Weeks
- Delta Smelt Releases
- Summary Tables
  - Smelt Monitoring Last 2 Weeks
  - Smelt Monitoring Water Year
  - Smelt Salvage Last 2 Weeks
  - Smelt Salvage Water Year
- Figures
- Water Year Tables
- Hourly Table
- Data Notes & Resources


## Smelt Monitoring Last 2 Weeks

**Smelt Monitoring Last 2 Weeks Catch by Life Stage. Delta Smelt Fork Length > 58mm = Adult, Fork Length 20-58mm = Juvenile, Fork Length < 20mm = Larva. Longfin Smelt Fork Length > 84mm = Adult, Fork Length 20-84mm = Juvenile, Fork Length < 20mm = Larva.**

| Monitoring | Species | Life Stage | First Date | Last Date | nfish | SacPAS Max Possible Date | SacPAS Data Retrieval Method |
|---|---|---|---|---|---|---|---|
| EDSM | Longfin Smelt | Juvenile | 2026-10-28 | 2026-10-28 | 1 | 2026-10-29 | Daily. Data are preliminary and are subject to correction and revision. |
| EDSM | Longfin Smelt | All Catch | 2026-10-28 | 2026-10-28 | 1 | 2026-10-29 | Daily. Data are preliminary and are subject to correction and revision. |

Table only displays species collected in the previous two weeks.

## Smelt Monitoring Water Year

No Delta Smelt or Longfin Smelt caught in monitoring efforts WY2027 based on daily EDSM and DJFMP weekly files.

## Smelt Salvage Last 2 Weeks

No Delta Smelt or Longfin Smelt caught in SWP and CVP Facilities last 2 weeks. Based on daily retrieval of CDFW Salvage DB.

SacPAS Max Possible Date: 2026-10-27

## Smelt Salvage Water Year

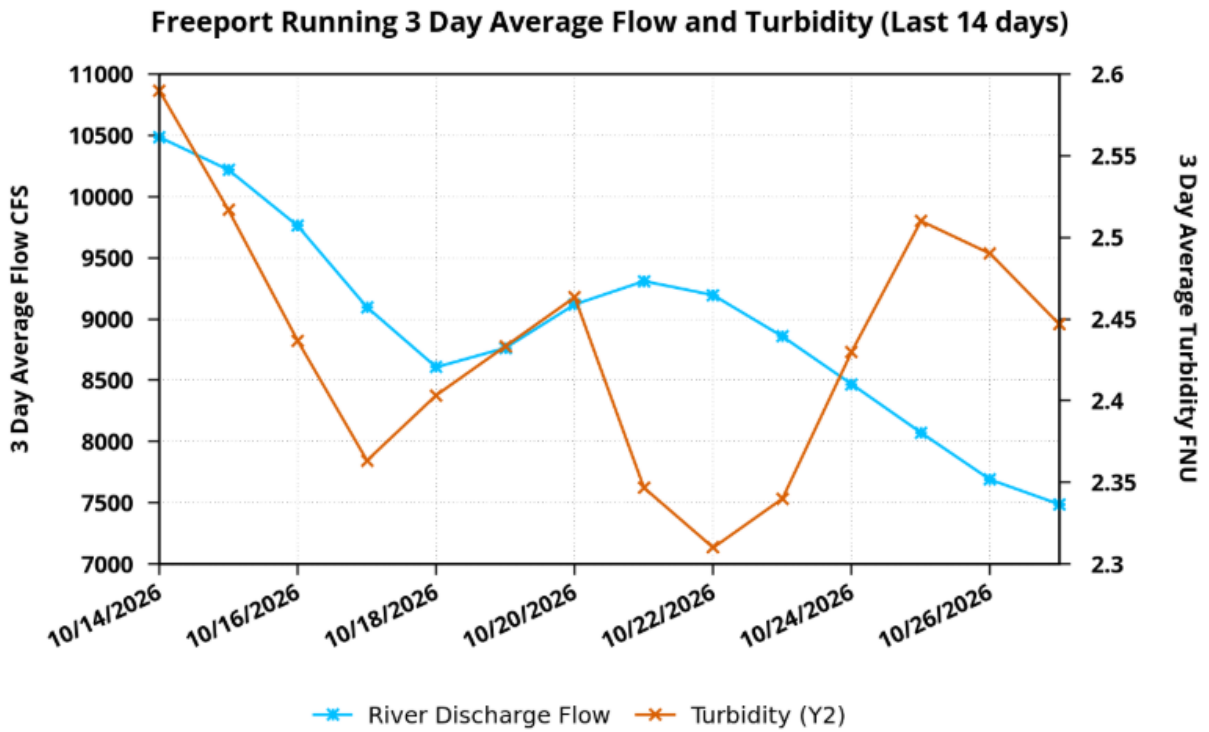
No Delta Smelt or Longfin Smelt caught in SWP and CVP Facilities WY2027. Based on daily retrieval of CDFW Salvage DB.

SacPAS Max Possible Date: 2026-10-27

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Daily Conditions for Last 2 Weeks
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Onset of OMR Management
Turbidity Bridge Avoidance
Larval and Juvenile Delta Smelt Protection
End of OMR Management
Operations and Hydrology
Water Year Tables ▶
Hourly Table
Data Notes & Resources

## Onset of OMR Management




Preliminary data from CDEC; subject to revision.

www.cbr.washington.edu/sacramento/
28 Oct 2026 16:35:01 PDT

The information on OMR Managment on this website is summarized for Delta Smelt from the OMR Entrainment Management Guidance Document and does not reflect a comprehensive description of each of the OMR actions.

"First Flush" conditions may be triggered between December 1 and January 31 and include: Running 3-day average of the daily flows at Freeport is greater than 25,000 cfs and running 3-day average of the daily turbidity at Freeport is 50 NTU or

ON THIS PAGE

- Daily Conditions for Last 2 Weeks
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- Summary Tables ▶
- Figures ▼
  - Water Temperature
  - Onset of OMR Management
  - Turbidity Bridge Avoidance
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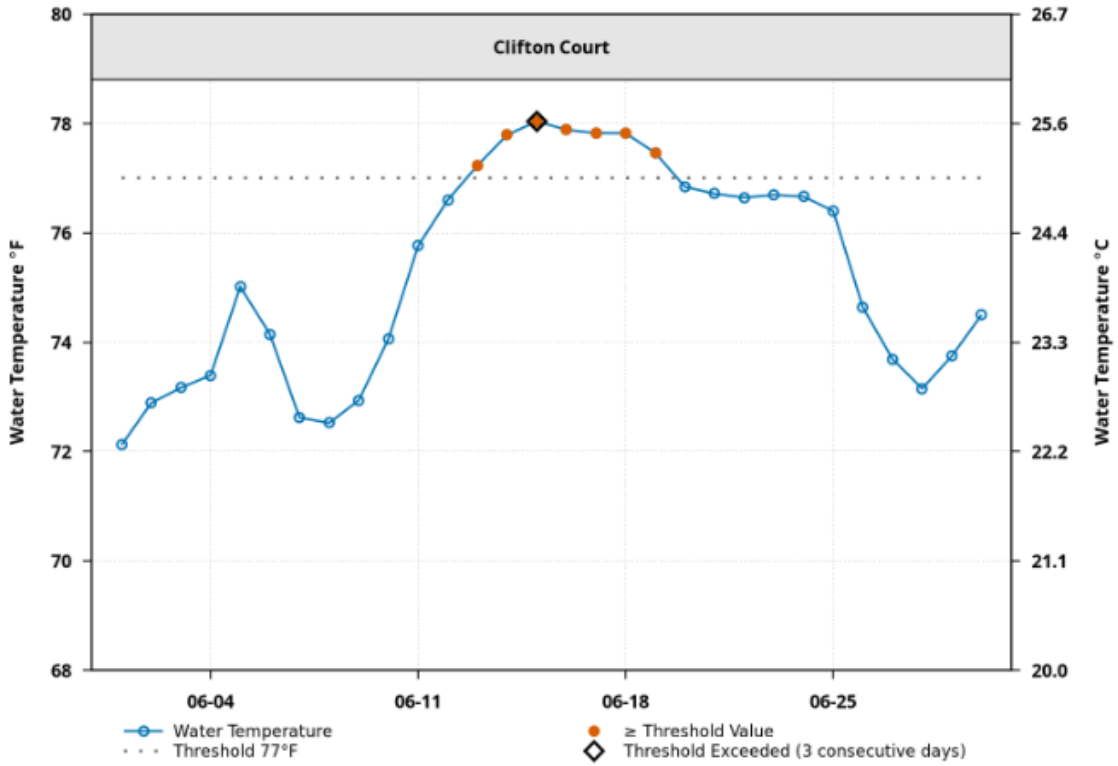
## End of OMR Management

Entrainment Management for Smelts: June 30 or after 3 consecutive days of daily mean water temperature at Clifton Court Forebay (CLC) ≥ 77.0°F (25°C).

**Water Temperature Thresholds for End of Smelts Entrainment Management (6/1/2026 - 6/30/2026)**

| Location | Threshold (°F/°C) | Days Above (n) | 3 Consecutive Days Above | Threshold Exceeded Date | Status |
|---|---|---|---|---|---|
| **Clifton Court [CDEC:CLC]** | ≥ 77°F / 25°C | 7 | 06/15, 06/16, 06/17, 06/18, 06/19 | 06/15 | Threshold Exceeded |

**Water Temperature Thresholds for End of Smelts Entrainment Management (6/1/2026 - 6/30/2026)**

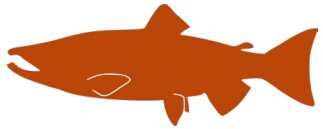



Smelts: June 30 or after 3 consecutive days of daily mean water temperature at Clifton Court Forebay (CLC) ≥ 77.0°F (25°C).

www.cbr.washington.edu/sacramento/
05 Oct 2026 07:35:33 PDT

# Data required for assessments: Salmonids

- Winter-run Juvenile Production Estimate (JPE)
- Salvage and loss
- Routing and survival probability



- Water temperature (end of season)



- EcoPTM modeling
- Flows



- **Winter-Run Chinook Salmon Juveniles**: If an assessment indicates annual salvage loss is on a trajectory to exceed 1% of the Juvenile Production Estimate (JPE) entering the Delta and a reduction in export pumping would materially increase through-Delta survival, Reclamation and DWR will reduce CVP and SWP exports to maintain an average OMRI no more negative than -3,500 cfs for at least 7 days and prepare a subsequent assessment.

  The annual salvage loss as a proportion of the winter-run Chinook salmon JPE shall be separately tracked by:

  1. Genetically confirmed unclipped winter-run Chinook salmon; and
  2. Releases from Livingston Stone National Fish Hatchery.

  If a Chinook salmon cannot be genotyped, it shall be identified based on Length-At-Date.

# Data required for assessments: Salmonids

- Spring-run Juvenile Production Estimate (JPE)
- Steelhead JPE
- Hatchery production releases
- Salvage and loss



- Water temperature (end of season)



- EcoPTM modeling



- **Spring-Run Chinook Salmon Juveniles**: If an assessment indicates annual salvage loss is on a trajectory to exceed 1% of the JPE entering the Delta and a reduction in export pumping would materially increase through-Delta survival, Reclamation and DWR will reduce CVP and SWP exports to maintain an average OMRI no more negative than -3,500 cfs for 7 days and prepare a subsequent assessment.

  The annual salvage loss as a proportion of the spring-run Chinook salmon JPE shall be tracked by surrogates:

  1. Yearling: Coleman Late-Fall Chinook Production Release
  2. Young of Year: Feather River Hatchery Spring-Run Production Releases

- **Steelhead Juveniles**: If an assessment indicates annual loss is on a trajectory to exceed 1% of the JPE entering the Delta and a reduction in export pumping would materially increase through-Delta survival, Reclamation and DWR will reduce CVP and SWP exports to maintain an average OMRI no more negative than -3,500 cfs for 7 days and a subsequent assessment.

  The annual salvage loss as a proportion of the steelhead JPE shall be estimated by the tracked by surrogates of hatchery steelhead released as part of normal hatchery practices.

  1. Sacramento River Origin: Coleman, Nimbus, and Feather River hatcheries Production Releases
  2. San Joaquin Origin: Mokelumne River Hatchery Production Releases

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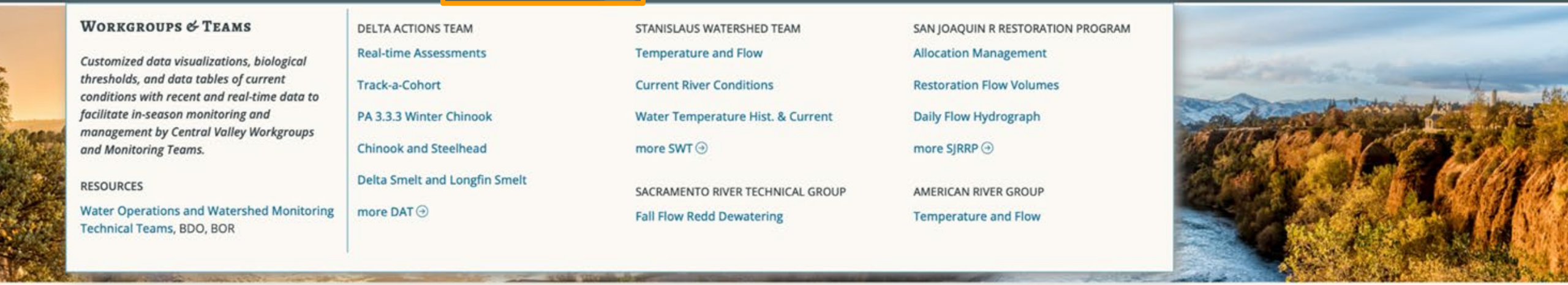
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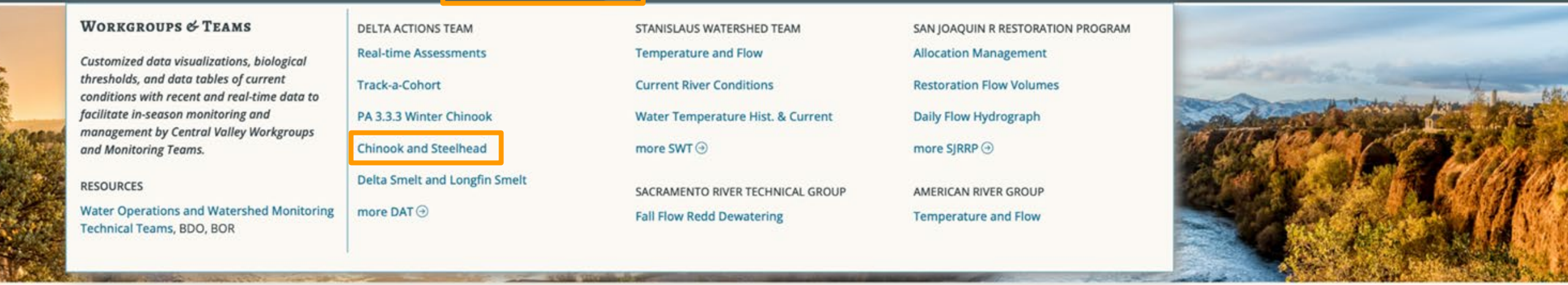
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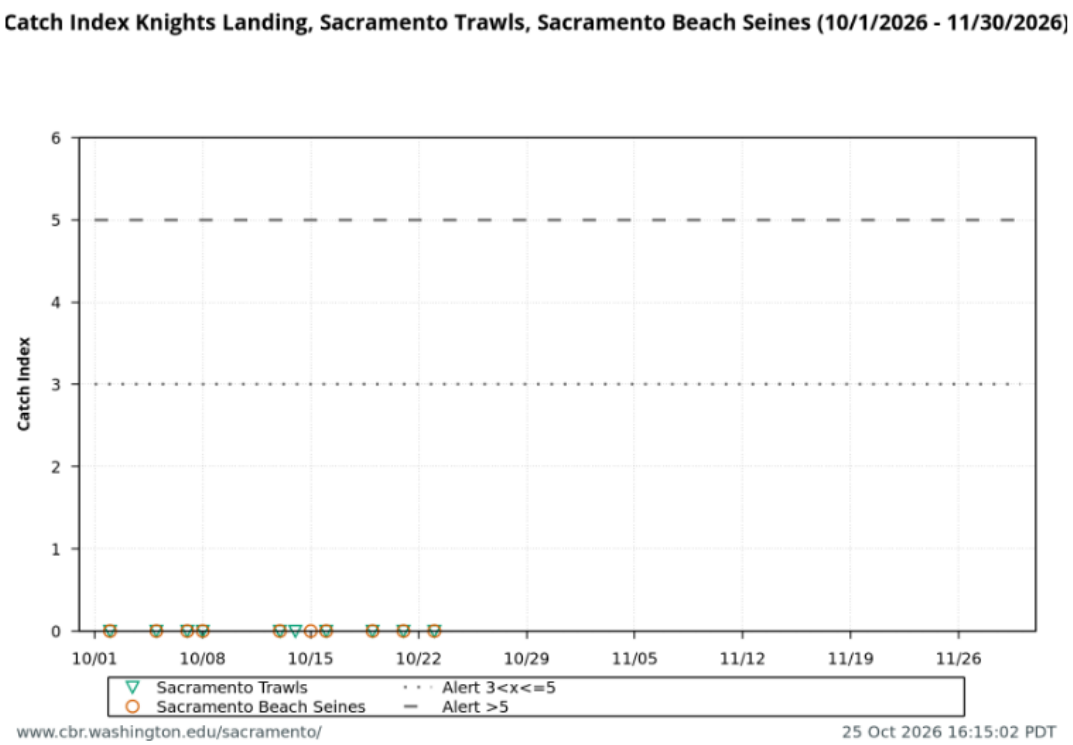



# Salmonids, Steelhead, and Current Conditions for the Delta Actions Team (DAT)

ON THIS PAGE


- DCC Operations
- Alerts: Deer Creek, Mill Creek, Wilkins Slough, Knights Landing
- Juvenile Sampling ▶
- Delta STARS Estimates
- Loss&Salvage Predictor Estimates ▶
- Spring Surrogates
- Single-Year Loss Thresholds ▶
- Entrainment Management
- Data Notes


## DCC Operations




Catch Index Knights Landing, Sacramento Trawls, Sacramento Beach Seines (10/1/2026 - 11/30/2026)

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## Alerts: Deer Creek, Mill Creek, Wilkins Slough, Knights Landing

### Daily Average Flow and Temperature Last 7 Days

| Date | Mill Creek (MLM): mean daily flow (cfs) | Mill Creek (MLM): flow percent change | Mill Creek (MLM): Alert | Deer Creek (DCV): mean daily flow (cfs) | Deer Creek (DCV): flow percent change | Deer Creek (DCV): Alert | Wilkins Slough (WLK): mean daily flow (cfs) | Knights Landing RST: water temperature (f) | WLK-KNL: Alert |
|---|---|---|---|---|---|---|---|---|---|
| 10/27/2026 | 107.8 | -0.8% | Flow>95cfs | 98.0 | -0.6% | Flow>95cfs | 4704.0 | 59.4 | |
| 10/26/2026 | 108.7 | -0.3% | Flow>95cfs | 98.6 | 0.6% | Flow>95cfs | 4721.7 | 59.3 | |
| 10/25/2026 | 109.0 | -1.7% | Flow>95cfs | 98.1 | -2.7% | Flow>95cfs | 4742.5 | 59.6 | |
| 10/24/2026 | 110.8 | -6.9% | Flow>95cfs | 100.8 | -5.1% | Flow>95cfs | 4765.6 | 59.5 | |
| 10/23/2026 | 119.0 | 8.1% | Flow>95cfs | 106.2 | 5.7% | Flow>95cfs | 4664.0 | 60.5 | |
| 10/22/2026 | 110.1 | 3.1% | Flow>95cfs | 100.5 | 3.0% | Flow>95cfs | 4407.4 | 60.9 | |
| 10/21/2026 | 106.8 | 1.9% | Flow>95cfs | 97.6 | 1.8% | Flow>95cfs | 4240.2 | 61.9 | |

Calculations generated by SacPAS. Data Courtesy of CDEC and CDFW via StreamNet.

r average daily flow >95 cfs or >50% change from prior day

lough average daily flow >7500 cfs and Knights Landing

From the LTO

Observations of daily increases in catch indices are typically associated with increased flows at Wilkins Slough and tributaries to the upper Sacramento River, cooler water temperatures at these locations, and entry of migrating juvenile winter-run and spring-run Chinook salmon (Del Rosario et al. 2013, White and Low 2006).

ON THIS PAGE

- DCC Operations
- Alerts: Deer Creek, Mill Creek, Wilkins Slough, Knights Landing
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  - Summary Last Two Weeks
  - Historical Migration Pattern for "Today"
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- Loss&Salvage Predictor Estimates
- Spring Surrogates
- Single-Year Loss Thresholds
- Entrainment Management
- Data Notes

## Historical Migration Pattern for "Today"

**Average Percent by 10/28, with 95%CI, of annual emigrating population for juveniles of each species of interest captured at the following locations and salvaged at SWP and CVP Delta facilities**

| Species | Red Bluff Diversion Dam | Tisdale RST | Knights Landing RST | Sac Trawl (Sherwood) Catch Index | Chipps Island Trawl Catch Index | Salvage |
|---|---|---|---|---|---|---|
| Chinook, LAD Winter-run, Unclipped | 72.7% (66.9%,78.6%) BY: 2015 - 2025 | 9.4% (4.0%,14.8%) BY: 2015 - 2025 | 10.4% (4.9%,15.9%) BY: 2015 - 2025 | 3.5% (-4.3%,11.2%) BY: 2015 - 2025 | 0.0% (0.0%,0.0%) BY: 2015 - 2025 | 0.0% (0.0%,0.0%) WY: 2017 - 2026 |
| Chinook, LAD Spring-run, Unclipped | 0.3% (-0.3%,0.8%) BY: 2015 - 2025 | 0.1% (-0.0%,0.2%) BY: 2015 - 2025 | 0.0% (-0.0%,0.1%) BY: 2015 - 2025 | 0.0% (0.0%,0.0%) BY: 2015 - 2025 | 0.0% (0.0%,0.0%) BY: 2015 - 2025 | 0.0% (0.0%,0.0%) WY: 2017 - 2026 |
| Steelhead, Unclipped (January-December) | | | | | | |
| Chinook, DNA Winter-run, Unclipped (Water Year) | | | | | | 0.0% (0.0%,0.0%) WY: 2018 - 2026 |
| Steelhead, Unclipped (Water Year) | | | | | | 0.0% (0.0%,0.0%) WY: 2017 - 2026 |

Calculations generated by SacPAS Migration Timing and Conditions by Cohort and Salvage Timing.
Data Courtesy of USFWS, Red Bluff; CDFW via StreamNet and CDEC; USFWS, Lodi.

# Delta STARS Estimates

ON THIS PAGE

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Current estimates generated by the Delta STARS tool. STARS Predicted Survival, Travel-Time and Routing for Late-Fall Run and Winter Run Chinook. Delta STARS developed by USGS Quantitative Fisheries Ecology Section and deployed by SacPAS.

### Delta STARS Survival and Routing Estimates

| Stock | Date | Route | Parameter | Estimate | Lower 80% Credible Limit | Upper 80% Credible Limit |
|---|---|---|---|---|---|---|
| Winter Chinook | 2026-10-27 | Overall | Median Travel Time | 0 | 0 | 0 |
| Winter Chinook | 2026-10-27 | Overall | Survival | 0.11055 | 0.07082 | 0.15763 |
| Winter Chinook | 2026-10-27 | Sacramento River | Median Travel Time | 0 | 0 | 0 |
| Winter Chinook | 2026-10-27 | Sacramento River | Routing Probability | 0.57573 | 0.52827 | 0.62076 |
| Winter Chinook | 2026-10-27 | Sacramento River | Survival | 0.1057 | 0.056609 | 0.1636 |
| Winter Chinook | 2026-10-27 | Yolo Bypass | Median Travel Time | 0 | 0 | 0 |
| Winter Chinook | 2026-10-27 | Yolo Bypass | Routing Probability | 0 | 0 | 0 |
| Winter Chinook | 2026-10-27 | Yolo Bypass | Survival | 0.58408 | 0.45888 | 0.70964 |
| Winter Chinook | 2026-10-27 | Sutter Slough | Median Travel Time | 0 | 0 | 0 |
| Winter | 2026- | | Routing | | | |

ON THIS PAGE


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Figure from Track-a-Cohort

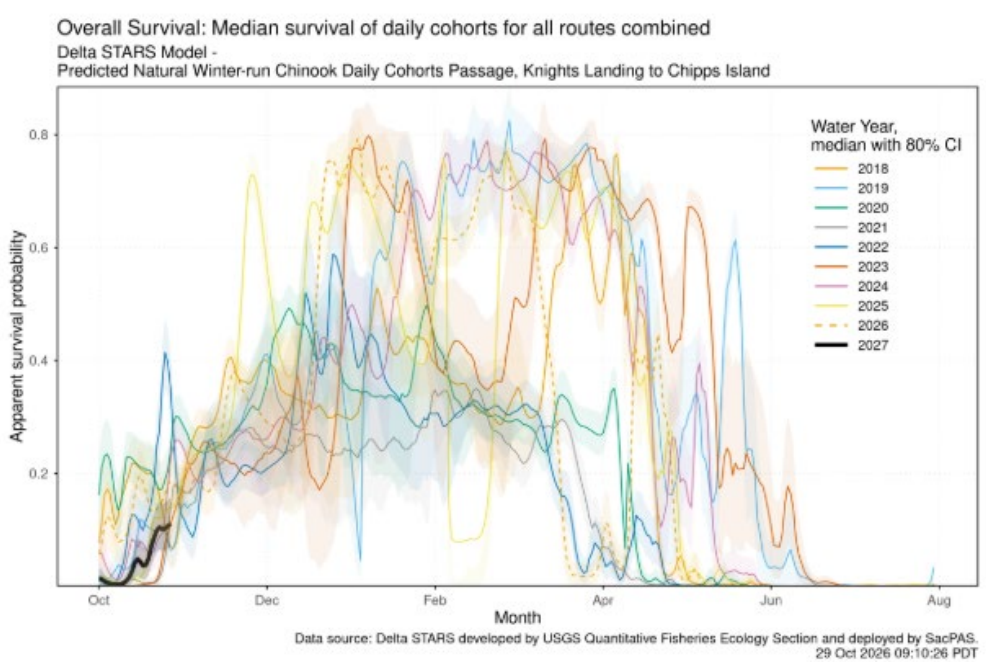
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### Delta STARS Survival and Routing Probabilities



# Automating Assessments

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[SacPAS magic happens]

Documents for review at technical team meetings

**Weekly Assessment for Delta Operations on ESA and CESA-listed Salmonids and Osmerids including Current Delta Hydrologic Conditions**

**Final: Tuesday, June 23, 2026 at 3 PM**

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Assessments (and code) online for public accessibility

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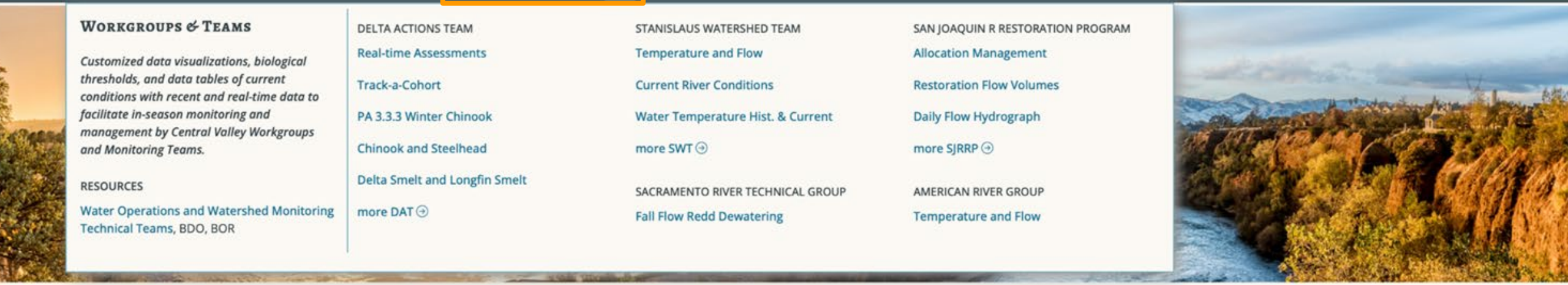
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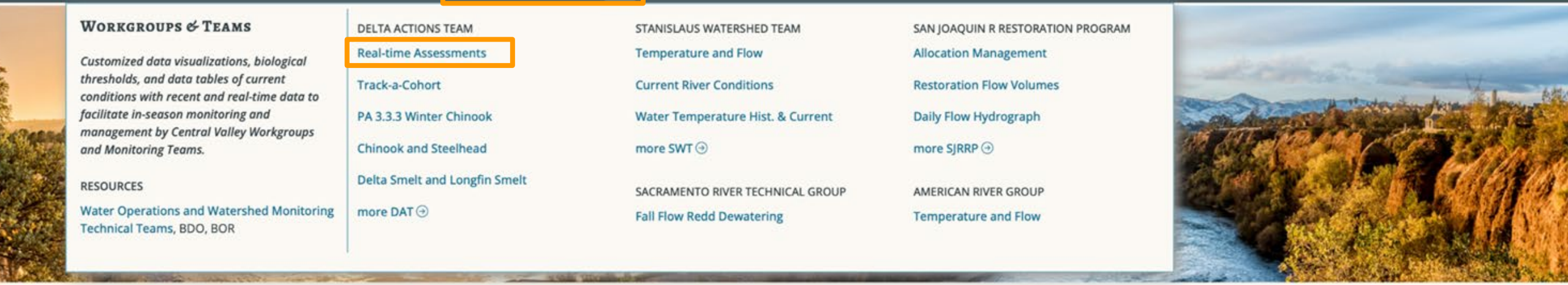
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# Real-time Assessments

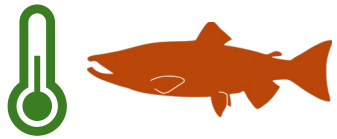
## Delta Assessments



### Delta Hydrology Assessment [HTML]

Updated: *2026-06-23, Tuesday at 3 PM*

Other formats — PDF Hydrology-only — Word Hydrology-only



### Winter Chinook, Steelhead, and Spring Chinook Assessment [HTML]

Updated: *2026-06-23, Tuesday at 3 PM*

Other formats — PDF Chinook & Steelhead-only — Word Chinook & Steelhead-only
Other formats with Hydrology — PDF Chinook, Steelhead and Hydrology — Word Chinook, Steelhead and Hydrology



### Smelt Assessment [HTML]

Updated: *2026-06-23, Tuesday at 3 PM*

Other formats — PDF Smelt-only — Word Smelt-only
Other formats with Hydrology — PDF Smelt and Hydrology — Word Smelt and Hydrology

### Combined Delta Hydrology, Chinook, Steelhead, and Smelt Assessments

Updated: *2026-06-23, Tuesday at 3 PM*

Available Formats — PDF Chinook, Steelhead, Smelt, and Hydrology — Word Chinook, Steelhead, Smelt, and Hydrology

## 1.2 Current Conditions

Most recent inflow at Freeport in the Sacramento River and Vernalis in the San Joaquin River is 28,591 and 2,727 cfs respectively. Most recent Jersey Point Flow (JPF) is NA cfs. Most recent 1-day, 5-day, and 14-day OMRI measurements were -3,261, -3,281, and -3,403



cfs, respectively, and most recent export data were 3,551 cfs for Jones Pumping Plant and 1,734 cfs for Henry O. Banks Pumping Plant.

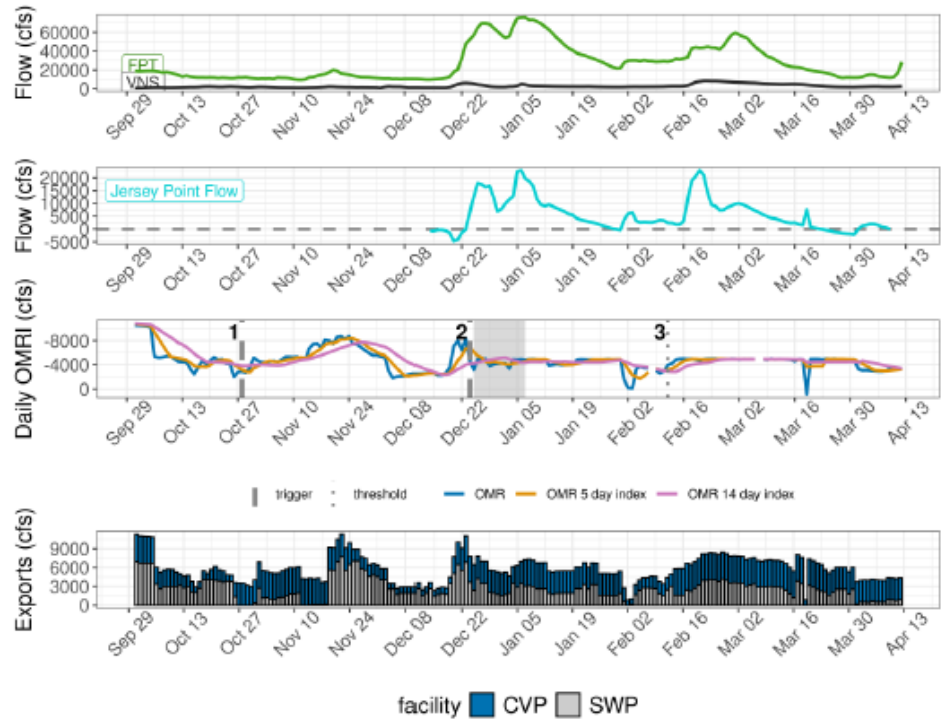



*Figure 1: Operations and Action Summary, WY 2026. The numbers and lines in the OMRI plot indicate different triggers and thresholds (see Table 1), with shading representing specific action periods. Dashed and dotted vertical lines represent triggered actions and thresholds, respectively. OMRI data (colored lines) calculated by SacPAS, Freeport (FPT)*

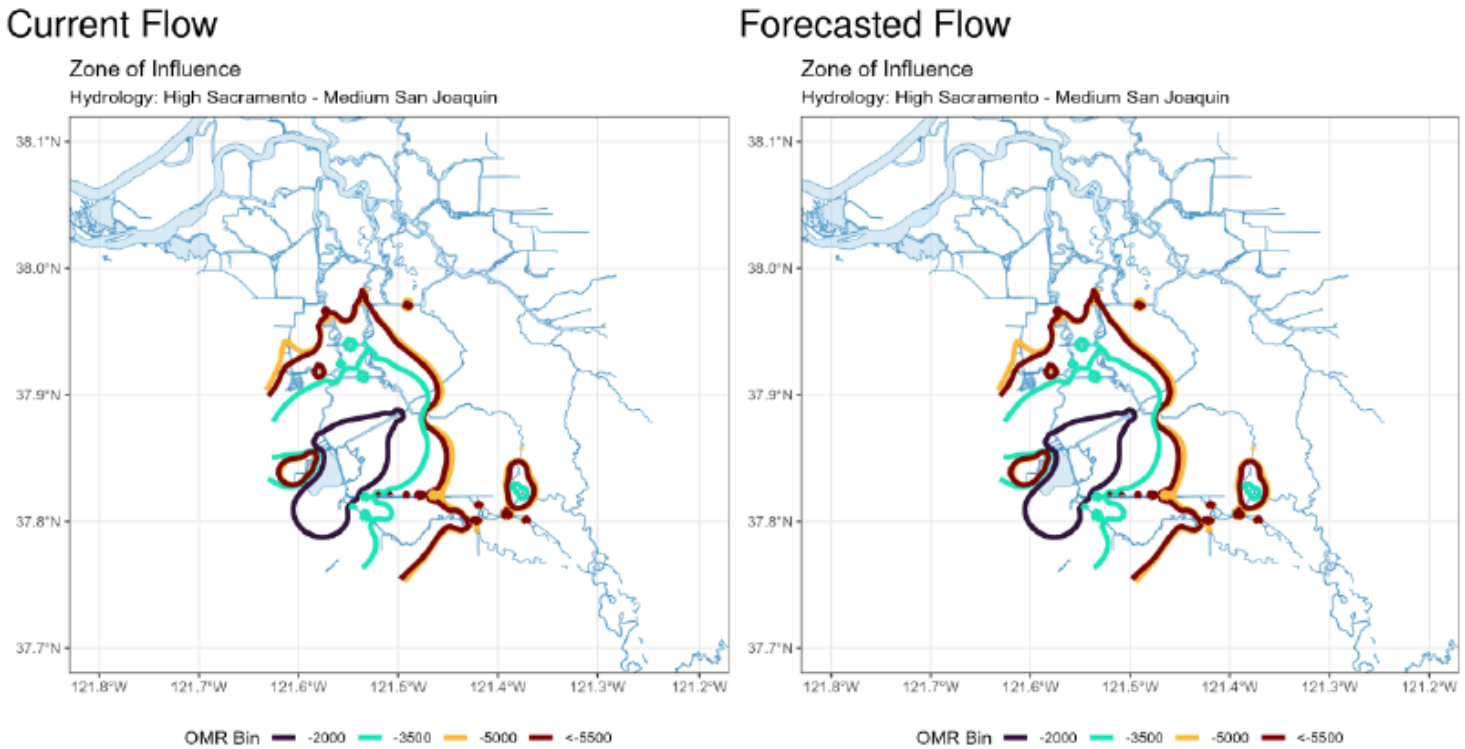
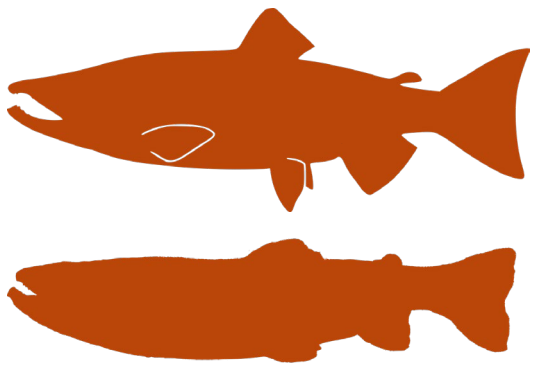



*Figure 2: Modeled Zone of Influence at different OMRI scenarios based on current inflow hydrology (left) and forecasted inflow hydrology (right) from the Sacramento River and San Joaquin River*

*Table 6: Summary of steelhead hatchery releases in Water Year 2026. JPE calculated using hatchery-specific survival estimates to Delta entry from release location.*

| Hatchery | Date of Release | Number Released | Estimated Survival | Juvenile Production Estimate |
|---|---|---|---|---|
| NIM | 2025-11-10 | 233,109 | 72% | 167,838 |
| Coleman | 2025-12-15 | 555,720 | 38% | 211,174 |
| Coleman | 2025-12-17 | 90,019 | 38% | 34,207 |
| FRH | 2026-01-06 | 376,640 | 36% | 135,590 |
| FRH | 2026-01-09 | 117,715 | 36% | 42,377 |
| MOK | 2026-02-17 | 39,130 | 25% | 9,783 |
| MOK | 2026-02-18 | 39,131 | 25% | 9,783 |
| MOK | 2026-03-18 | 41,550 | 27% | 11,219 |
| MOK | 2026-03-19 | 42,150 | 27% | 11,381 |



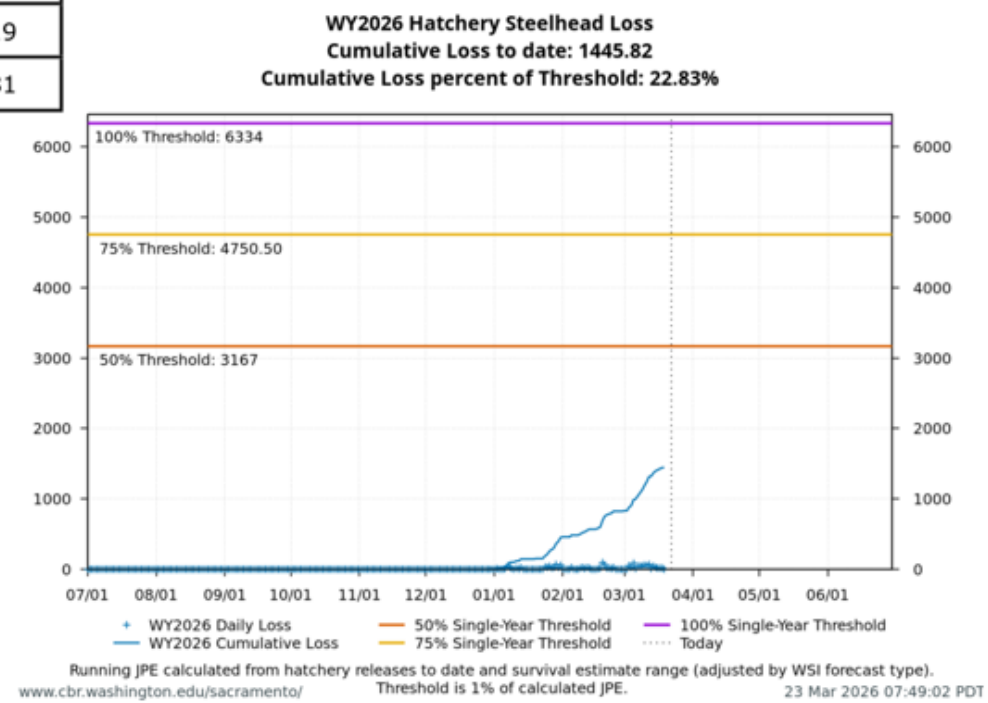
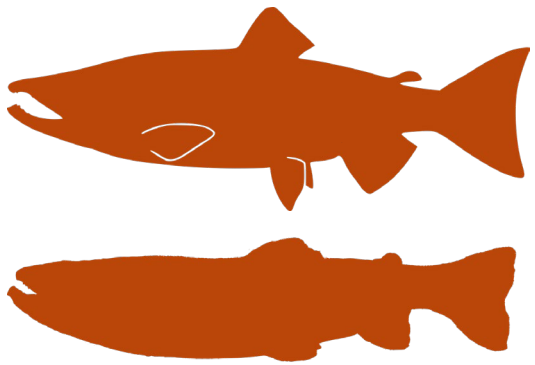



*Figure 8: Cumulative loss of hatchery steelhead for WY 2026.*



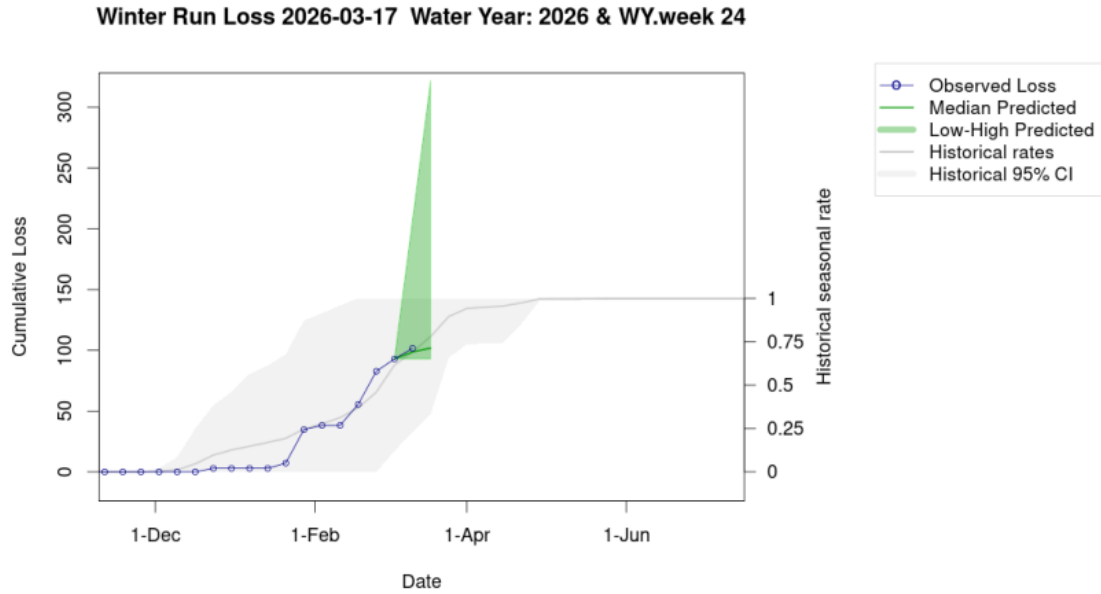



*Figure 9: Estimates of winter-run Chinook loss generated by Loss and Salvage Predictor tool.*

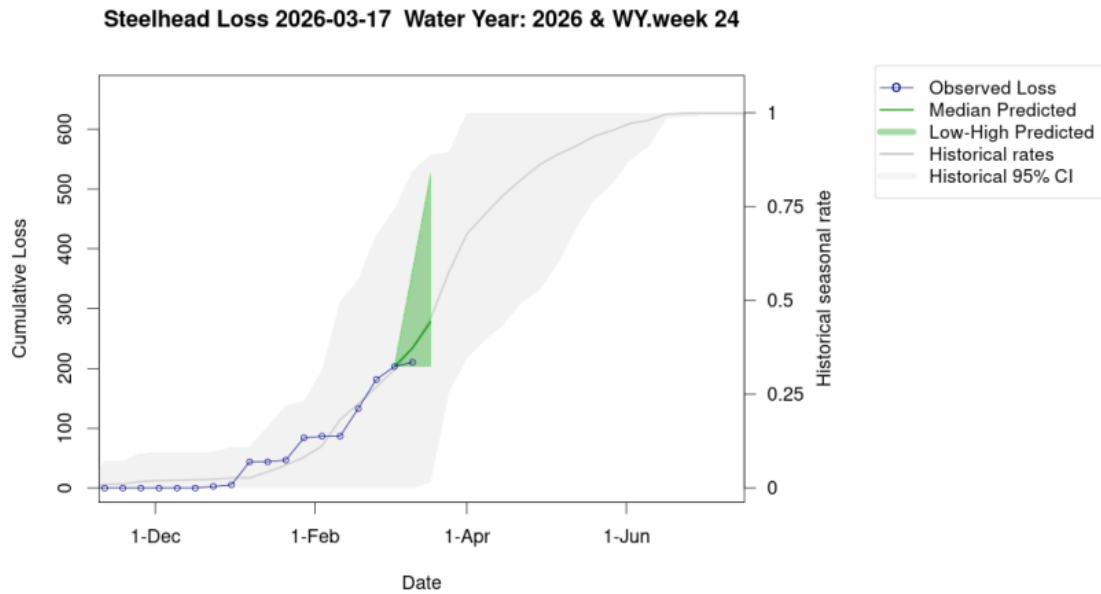
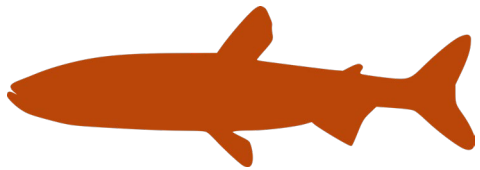



*Figure 10: Estimates of steelhead loss generated by Loss and Salvage Predictor tool.*



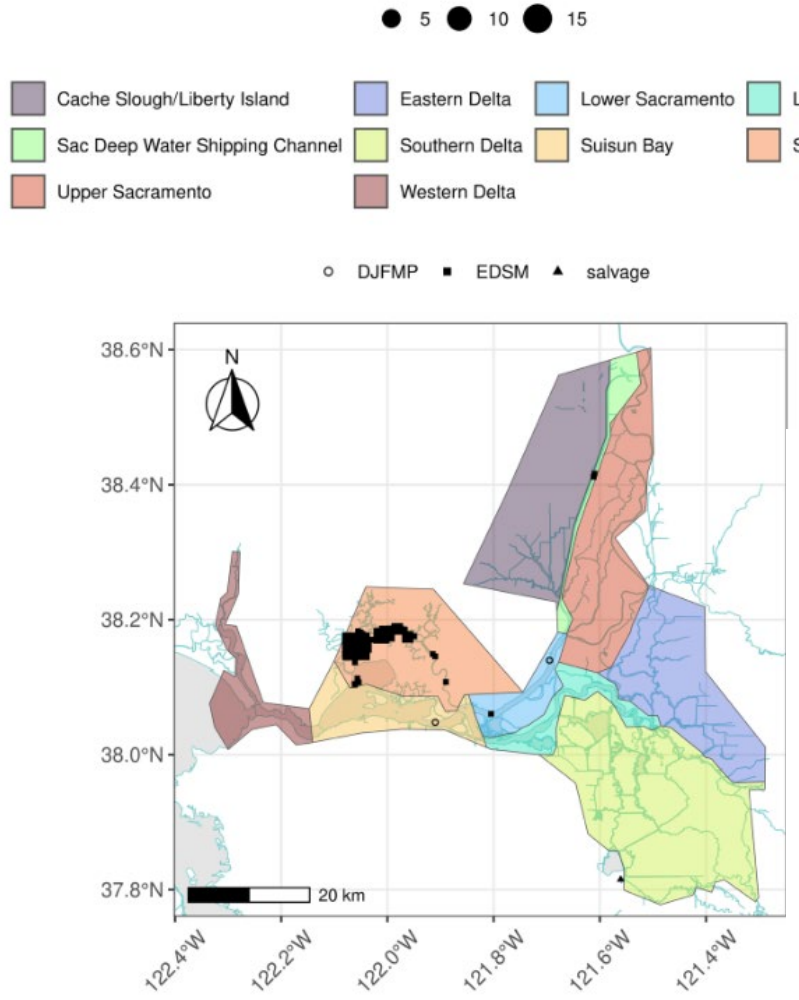



*Figure 11: Delta smelt distribution for WY 2026*

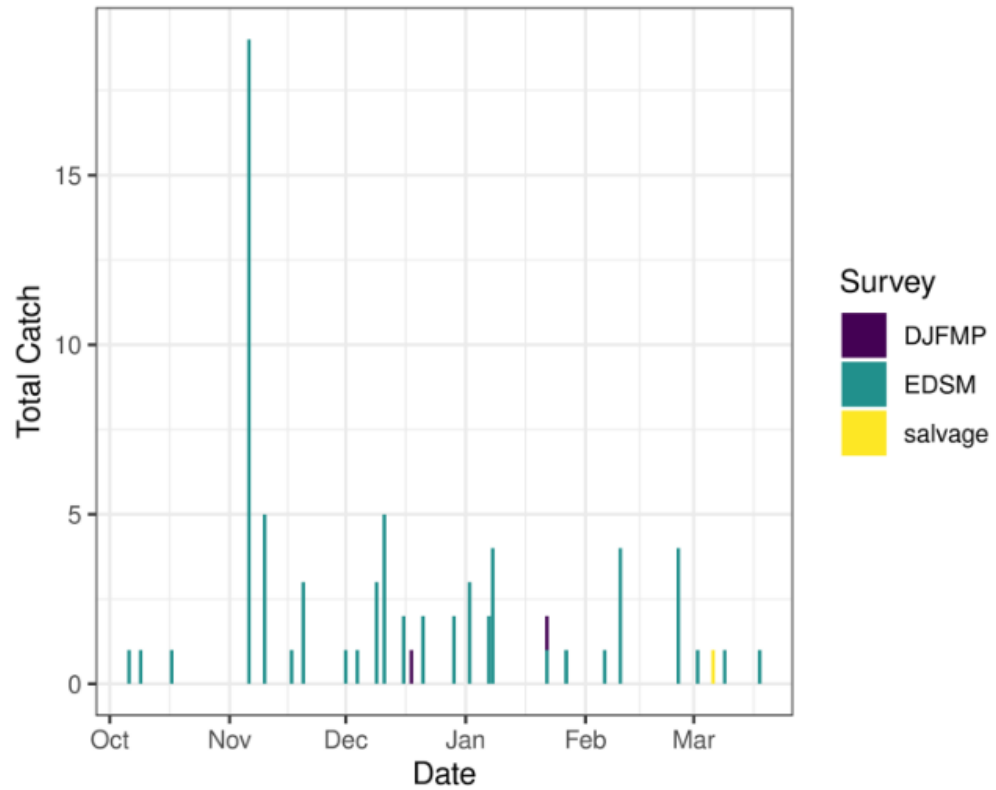


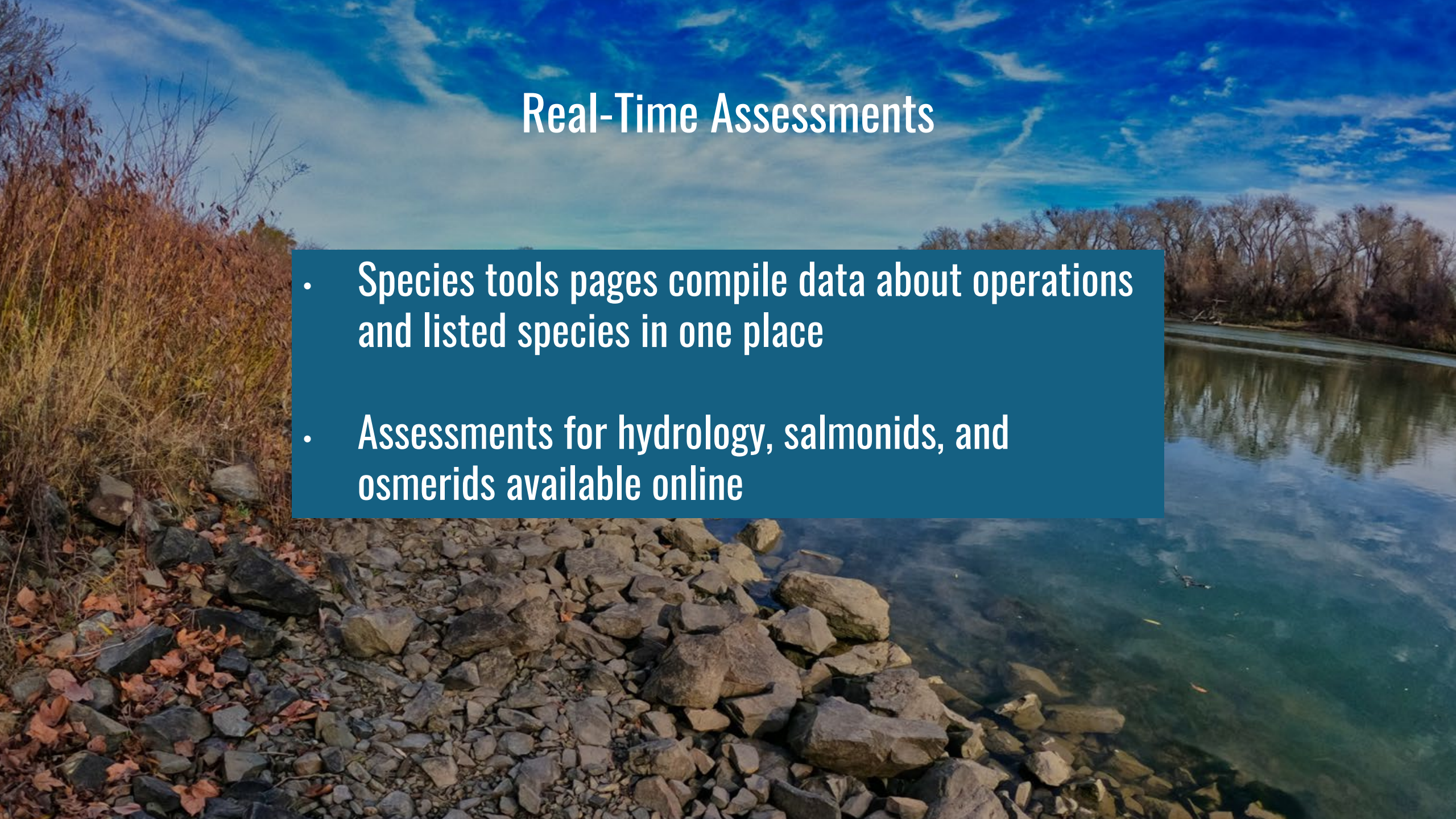

*Figure 12: Time series of Delta smelt catch, WY 2026*

# Weekly Assessment for Delta Operations on ESA and CESA-listed Salmonids and Osmerids including Current Delta Hydrologic Conditions

Last updated: Monday, March 23, 2026 at 8 AM

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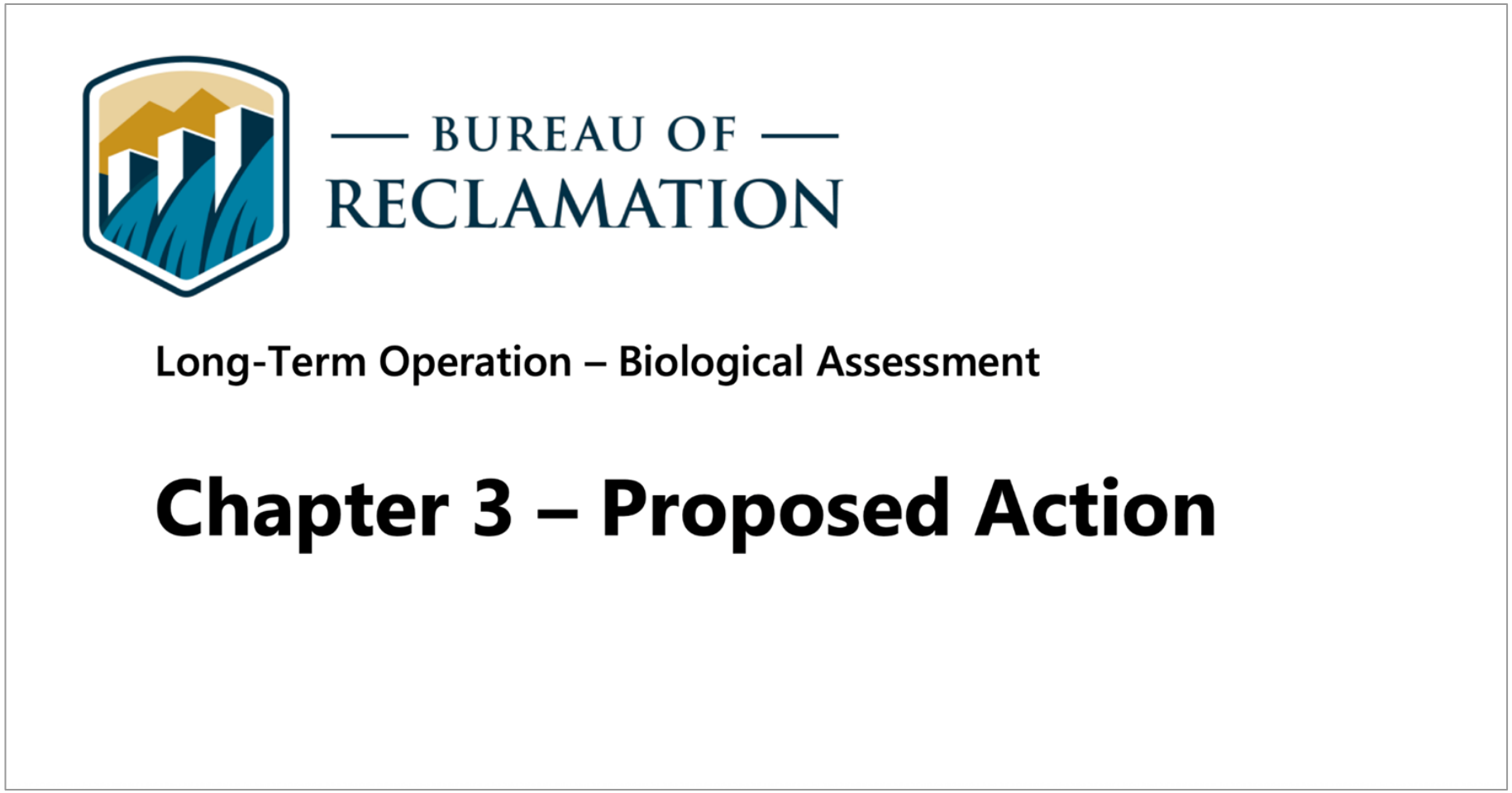
# Real-Time Assessments

- Species tools pages compile data about operations and listed species in one place
- Assessments for hydrology, salmonids, and osmerids available online



# Winter-run Chinook Salmon
# Annual Brood Year Assessment Indicators
# (Proposed Action, section 3.3.3)

# Following what is in Proposed Action of LTO BA (Oct 2024)




https://www.usbr.gov/mp/nepa/includes/documentShow.php?Doc_ID=55343

# Following what is in Proposed Action of LTO BA (Oct 2024), Section 3.3.3

BUREAU OF RECLAMATION

Long-Term Operation – Biological Assessment

## Chapter 3 – Proposed Action

### 3.3.3 Annual Winter-run Chinook Salmon Broodyear Assessment

In order to inform operations, risk tradeoffs for determining the downstream extent of water temperature management, and the need to pursue increasing production or taking other actions at LSNFH, the JPE SubTeam will conduct a winter-run Chinook salmon broodyear assessment for the previous year's cohort and the cohort of return adults that hatched three years prior. The purpose is to track species conditions and take appropriate actions to avoid adverse impacts to the following year's cohort. If the previous year's cohort and the cohort three years prior, is determined to have experienced "adverse conditions", then more actions would be taken to manage the objectives for each Bin, including both biological and drought protection objectives. The broodyear assessment will be developed by February 1 or each year using the best available science to guide calculation of each metric described below. The broodyear assessment will be

3-25

based on the best available science each year and the JPE SubTeam may consider using the following indicators or information:

- >30% TDM
- <20% ETF survival
- 25% of historic JPE
- TMP compliance point was above CCR
- Adverse Population Viability Trends (per previous year's annual brood year report if there was an increase in any of the five criteria in Lindley et. al. 2007)
- High Risk of Extinction (per 5 year status review)
- Outyear adult escapement forecast based on Pacific Fishery Management Council winter-run stock abundance analyses

The JPE SubTeam will provide the broodyear assessment to Reclamation and the SHOT. If the broodyear assessment determines Adverse Conditions for Winter-run Chinook salmon and identifies that Shasta storage and hydrology are expected to result in continuing adverse conditions to the coming broodyear, the SHOT will report these conditions and proposed actions to the Directors and all reasonable actions will be taken to avoid continued adverse conditions. These indicators of broodyear strength can be revised by the SHOT with NMFS approval.

https://www.usbr.gov/mp/nepa/includes/documentShow.php?Doc_ID=55343

# Following what is in Proposed Action of LTO BA (Oct 2024), Section 3.3.3

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3-25

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3. 25% of historic JPE
   - TMP compliance point was above CCR
   - Adverse Population Viability Trends (per previous year's annual brood year report if there was an increase in any of the five criteria in Lindley et. al. 2007)
   - High Risk of Extinction (per 5 year status review)
4. Outyear adult escapement forecast based on Pacific Fishery Management Council winter-run stock abundance analyses

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## Workgroups & Teams

*Customized data visualizations, biological thresholds, and data tables of current conditions with recent and real-time data to facilitate in-season monitoring and management by Central Valley Workgroups and Monitoring Teams.*

RESOURCES

Water Operations and Watershed Monitoring Technical Teams, BDO, BOR

DELTA ACTIONS TEAM

Real-time Assessments

Track-a-Cohort

PA 3.3.3 Winter Chinook

Chinook and Steelhead

Delta Smelt and Longfin Sr

more DAT

STANISLAUS WATERSHED TEAM

Temperature and Flow

Current River Conditions

Water Temperature Hist. & Current

more SWT

SACRAMENTO RIVER TECHNICAL GROUP

Fall Flow Redd Dewatering

SAN JOAQUIN R RESTORATION PROGRAM

Allocation Management

Restoration Flow Volumes

Daily Flow Hydrograph

more SJRRP

AMERICAN RIVER GROUP

Temperature and Flow

## Access

Data and decision support tools on fishes and environmental conditions

## Research

Fish survival and migration models, presentations, and publications

## Connections

Collaborators, practitioners, stakeholders, students, knowledge, and experiences






# Annual Brood Year Assessment Indicators based on PA 3.3.3 (Reclamation 2024) for Sacramento River Winter Chinook

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- Current Brood Year Assessment Indicators
- Winter Chinook Indicators Summary
- Temperature-dependent Mortality (TDM)
- Egg-to-fry (ETF) Survival
- Juvenile Production Estimate (JPE)
- Temperature Compliance Point (TCP)
- Extinction Risk
- Outyear Adult Escapement Forecast
- PA 3.3.3 Quoted Text
- Extinction Risk and Population Metrics Definitions
- References

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## Current Brood Year Assessment Indicators

**2025 Brood Year Assessment Indicators including TDM, ETF, JPE, and Adult Escapement Forecast. Temperature-dependent Mortality (TDM) sourced from SacPAS Fish Model applying Anderson et. al (2022) and Martin et. al (2017) models. Egg-to-fry (ETF) Survival and Natural Origin JPE sourced from annual JPE Letters (compiled by SacPAS at JPE Letter Data). Outyear Adult Escapement Forecast sourced from Table II-2 (PFMC 2025a).**

| Assessment Year | Brood Year | Adult Return Year; BY of Adults | >30% TDM | <20% ETF Survival | 25% JPE (Natural Origin) 3-year Mean | 25% JPE (Natural Origin) 10-year Mean | 25% JPE (Natural Origin) All Years Mean | Outyear Adult Escapement Forecast |
|---|---|---|---|---|---|---|---|---|
| 2025 | 2025 | 2025; 2022 | No | Yes | 115936.8 | 88801.2 | 187527.3 | 4507 |

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|---|---|---|---|---|---|---|---|---|
| 2025 | 2025 | 2025; 2022 | No | Yes | 115936.8 | 88801.2 | 187527.3 | 4507 |

*Winter-run Chinook Salmon Annual BY Assessment Indicators (PA 3.3.3)*

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# Annual Brood Year Assessment Indicators based on PA 3.3.3 (Reclamation 2024) for Sacramento River Winter Chinook

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| Assessment Year | Brood Year | Adult Return Year; BY of Adults | 1 >30% TDM | 2 <20% ETF Survival | 3 25% JPE (Natural Origin) 3-year Mean | 25% JPE (Natural Origin) 10-year Mean | 25% JPE (Natural Origin) All Years Mean | 4 Outyear Adult Escapement Forecast |
|---|---|---|---|---|---|---|---|---|
| 2025 | 2025 | 2025; 2022 | No | Yes | 115936.8 | 88801.2 | 187527.3 | 4507 |

*Winter-run Chinook Salmon Annual BY Assessment Indicators (PA 3.3.3)*

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download CSV

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|---|---|---|---|---|---|---|---|---|
| 2025 | 2025 | 2025; 2022 | No | Yes | 115936.8 | 88801.2 | 187527.3 | 4507 |
| 2024 | 2024 | 2024; 2021 | No | No | 31976.1 | 64907.8 | 181189.0 | 1013 |
| 2023 | 2023 | 2023; 2020 | No | No | 34154.8 | 65548.5 | 186236.3 | 4540 |
| 2022 | 2022 | 2022; 2019 | No | Yes | 42091.0 | 89585.8 | 190486.7 | 5971 |
| 2021 | 2021 | 2021; 2018 | Yes | Yes | 109175.8 | 101657.9 | 196624.8 | 9063 |
| 2020 | 2020 | 2020; 2017 | No | Yes | 134853.9 | 102583.2 | 202530.7 | 3077 |
| 2019 | 2019 | 2019; 2016 | No | Yes | 124127.2 | 102630.3 | 206975.1 | 1924 |
| 2018 | 2018 | 2018; 2015 | No | No | 66731.2 | 110747.6 | 206715.1 | 1594 |
| 2017 | 2017 | | No | No | 39109.5 | 115362.8 | 210652.0 | |
| 2016 | 2016 | | No | No | 32702.2 | 122586.1 [b] | 217331.1 | |
| 2015 | 2015 | | Yes | Yes | 118552.0 | 221832.8 [b] | 224973.9 | |

*Winter-run Chinook Salmon Annual BY Assessment Indicators (PA 3.3.3)*

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|---|---|---|---|---|---|---|---|---|
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| 2022 | 2022 | 2022; 2019 | No | Yes | 42091.0 | 89585.8 | 190486.7 | 5971 |
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| 2017 | 2017 | | No | No | 39109.5 | 115362.8 | 210652.0 | |
| 2016 | 2016 | | No | No | 32702.2 | 122586.1 [b] | 217331.1 | |
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## Temperature-dependent Mortality (TDM)

Annual update to TDM estimates available November/December.

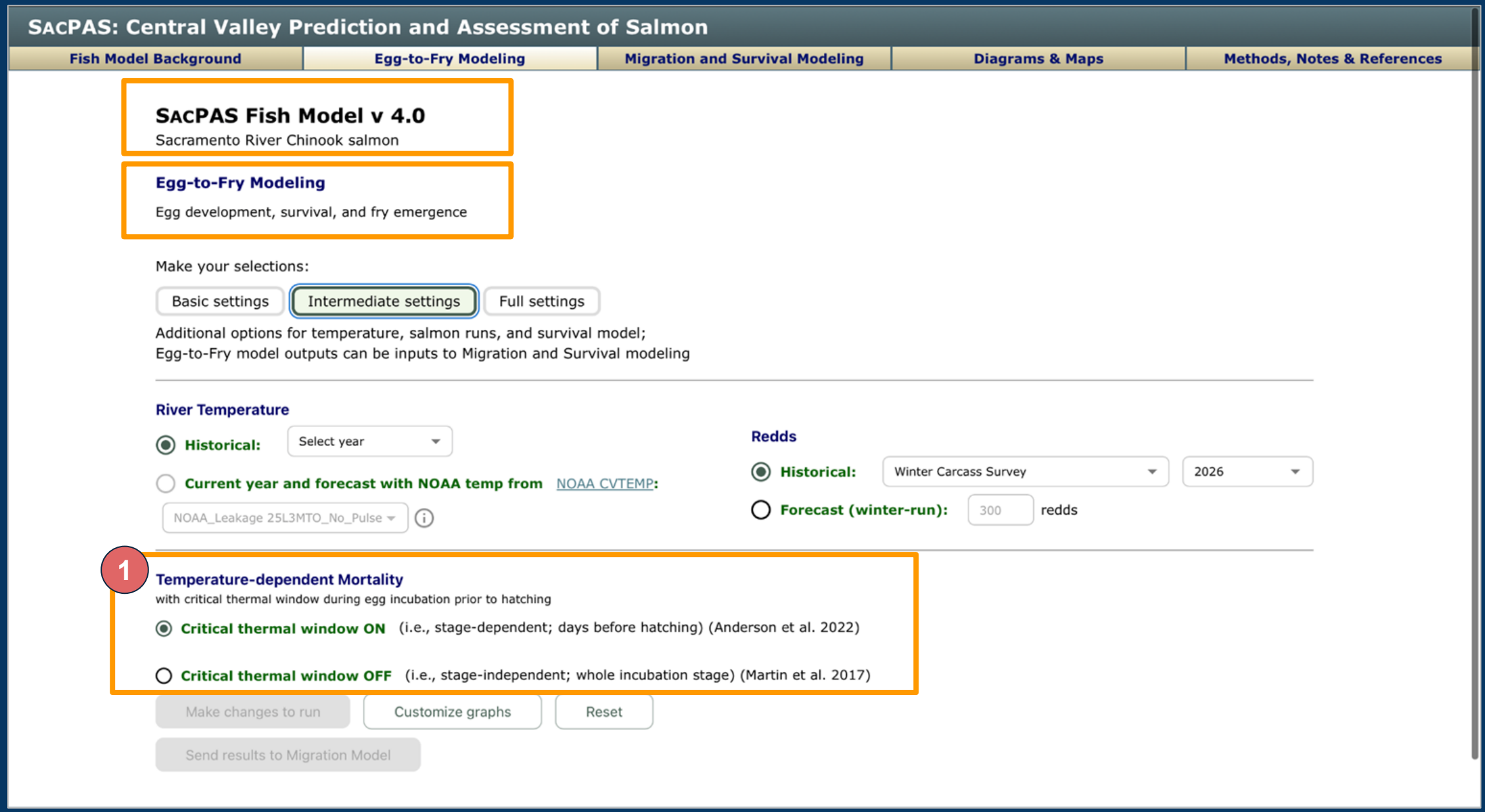
Related SacPAS resource: SacPAS Fish Model

download CSV

Temperature-dependent Mortality (TDM) using Anderson et. al (2022) and Martin et. al (2017) models; TDM generated using SacPAS F del

1 1

| Brood Year | TDM using Anderson et. al (2022) | Anderson-TDM Exceed 30% | TDM using Martin et. al (2017) | Martin-TDM Exceed 30% |
|---|---|---|---|---|
| 2025 | 0.0000 | No | 0.0000 | No |
| 2024 | 0.0065 | No | 0.0034 | No |
| 2023 | 0.0000 | No | 0.0000 | No |
| 2022 | 0.0702 | No | 0.1648 | No |
| 2021 | 0.7347 | Yes | 0.7553 | Yes |
| 2020 | 0.0114 | No | 0.0196 | No |
| 2019 | 0.0041 | No | 0.0020 | No |
| 2018 | 0.0001 | No | 0.0164 | No |
| 2017 | 0.0176 | No | 0.0030 | No |
| 2016 | 0.0039 | No | 0.0024 | No |
| 2015 | 0.8772 | Yes | 0.8404 | Yes |
| 2014 | 0.7642 | Yes | 0.7609 | Yes |
| 2013 | 0.1142 | No | 0.0649 | No |
| 2012 | 0.0000 | No | 0.0000 | No |
| 2011 | 0.0000 | No | 0.0000 | No |
| 2010 | 0.0000 | No | 0.0009 | No |
| 2009 | 0.1562 | No | 0.0974 | No |
| 2008 | 0.3929 | Yes | 0.3008 | Yes |


SacPAS: Central Valley Prediction and Assessment of Salmon
Fish Model Background
Egg-to-Fry Modeling
Migration and Survival Modeling
Diagrams & Maps
Methods, Notes & References
SacPAS Fish Model v 4.0
Sacramento River Chinook salmon
Egg-to-Fry Modeling
Egg development, survival, and fry emergence
Make your selections:
Basic settings
Intermediate settings
Full settings
Additional options for temperature, salmon runs, and survival model;
Egg-to-Fry model outputs can be inputs to Migration and Survival modeling
River Temperature
Historical:
Select year
Current year and forecast with NOAA temp from NOAA CVTEMP:
NOAA_Leakage 25L3MTO_No_Pulse
Redds
Historical:
Winter Carcass Survey
2026
Forecast (winter-run):
300
redds
1
Temperature-dependent Mortality
with critical thermal window during egg incubation prior to hatching
Critical thermal window ON (i.e., stage-dependent; days before hatching) (Anderson et al. 2022)
Critical thermal window OFF (i.e., stage-independent; whole incubation stage) (Martin et al. 2017)
Make changes to run
Customize graphs
Reset
Send results to Migration Model

*Winter-run Chinook Salmon Annual BY Assessment Indicators (PA 3.3.3)*

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2

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|---|---|---|---|---|---|---|---|---|
| 2025 | 2025 | 2025; 2022 | No | Yes | 115936.8 | 88801.2 | 187527.3 | 4507 |
| 2024 | 2024 | 2024; 2021 | No | No | 31976.1 | 64907.8 | 181189.0 | 1013 |
| 2023 | 2023 | 2023; 2020 | No | No | 34154.8 | 65548.5 | 186236.3 | 4540 |
| 2022 | 2022 | 2022; 2019 | No | Yes | 42091.0 | 89585.8 | 190486.7 | 5971 |
| 2021 | 2021 | 2021; 2018 | Yes | Yes | 109175.8 | 101657.9 | 196624.8 | 9063 |
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| 2016 | 2016 | | No | No | 32702.2 | 122586.1 [b] | 217331.1 | |
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- Temperature Compliance Point (TCP)
- Extinction Risk
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- Extinction Risk and Population Metrics Definitions
- References

## Egg-to-fry (ETF) Survival

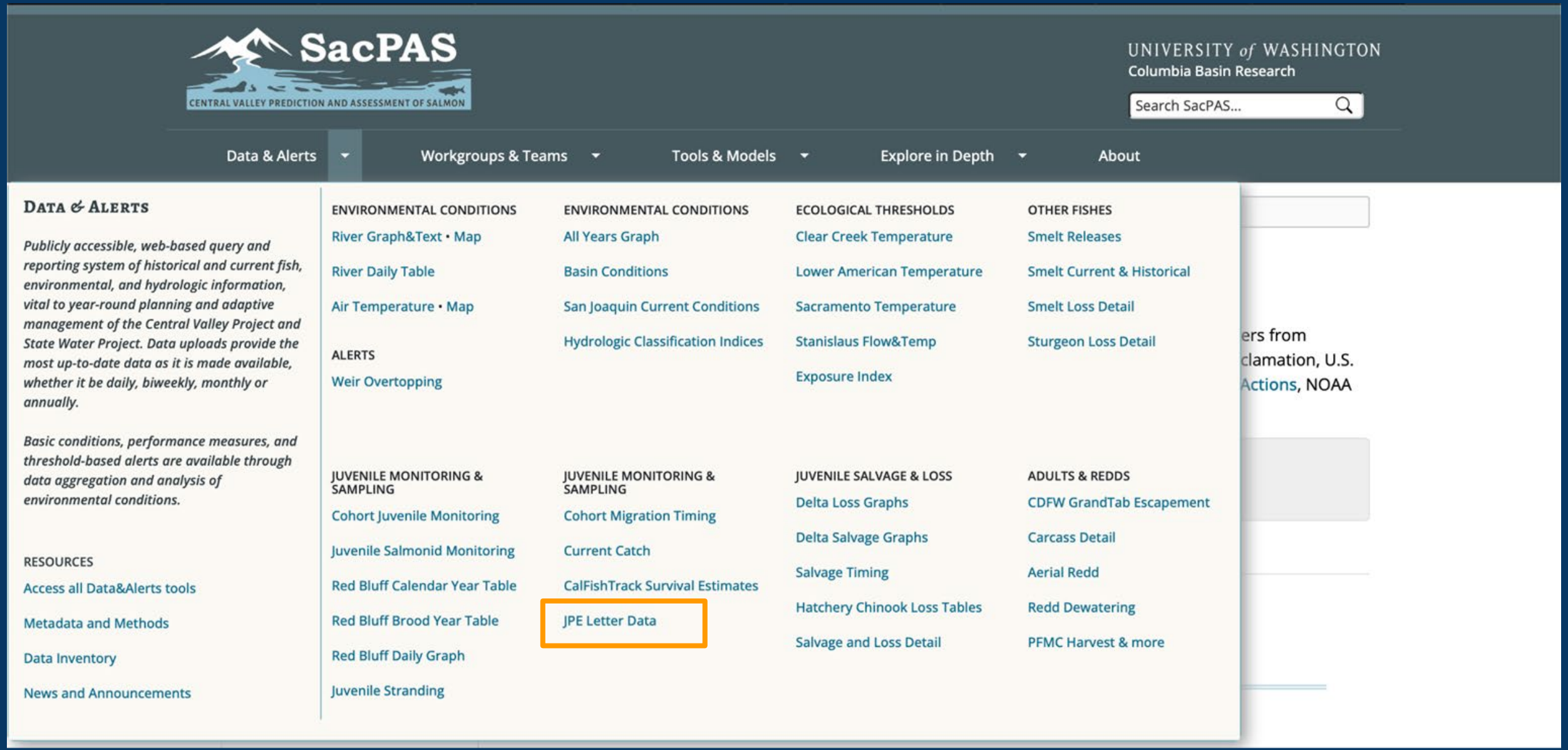
Annual update to ETF Survival from JPE Letter available January/February.

Related SacPAS resource: Juvenile Production Estimates (JPE) for Sacramento River Winter-run Chinook Salmon

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Egg-to-fry (ETF) Survival from annual JPE Letters

| Brood year | ETF Survival | ETF Survival <20% | JPE Letter Date | JPE Letter Footnote | JPE Letter References & Contributors |
|---|---|---|---|---|---|
| 2025 | 0.1273 | Yes | 2026-01-08 | 5/ Back calculated estimated survival between eggs laid in-river and fry production estimates at RBDD based on numbers of fry equivalents (JPI) using the 0.5217 fry-to-smolt survival rate estimate based on method described in O'Farrell et al. (2018). | CDFW, LSNFH, USFWS |
| 2024 | 0.2884 | No | 2025-01-10 | 5/ Back calculated estimated survival between eggs laid in-river and fry production estimates at RBDD based on numbers of fry equivalents (JPI) using the 0.5149 fry-to-smolt survival rate estimate based on method described in O'Farrell et al. (2018). | CDFW, LSNFH, USFWS |
| 2023 | 0.2494 | No | 2024-01-12 | 5/ Back calculated estimated survival between eggs laid in-river and fry production estimates at RBDD based on numbers of fry equivalents (JPI) using the 0.5066 fry-to-smolt survival rate estimate based on method described in O'Farrell et al. (2018). | CDFW, LSNFH, USFWS |
| 2022 | 0.0217 | Yes | 2023-01-13 | 5/ Back calculated estimated survival between eggs laid in-river and fry production estimates at RBDD based on numbers of fry equivalents (JPI) using the 0.4946 fry-to-smolt survival rate estimate based on method | CDFW, LSNFH, USFWS |


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# Juvenile Production Estimates (JPE) for Sacramento River Winter-run Chinook Salmon

Data extracted by SacPAS from "Juvenile Production Estimates (JPE) for Sacramento River Winter-run Chinook Salmon by Brood Year" letters from National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce to the Bureau of Reclamation, U.S. Department of the Interior (hereafter termed "JPE letter"), available from California Central Valley Water Operations: Biological Opinion Actions, NOAA Fisheries. Juvenile Production Estimates (JPE) Methods through the years.

**Download (tab-delimited TXT file):** All Brood Years Submit Generate Query Result Link Only ?

Natural Origin Hatchery Origin

***JPE Letter data***

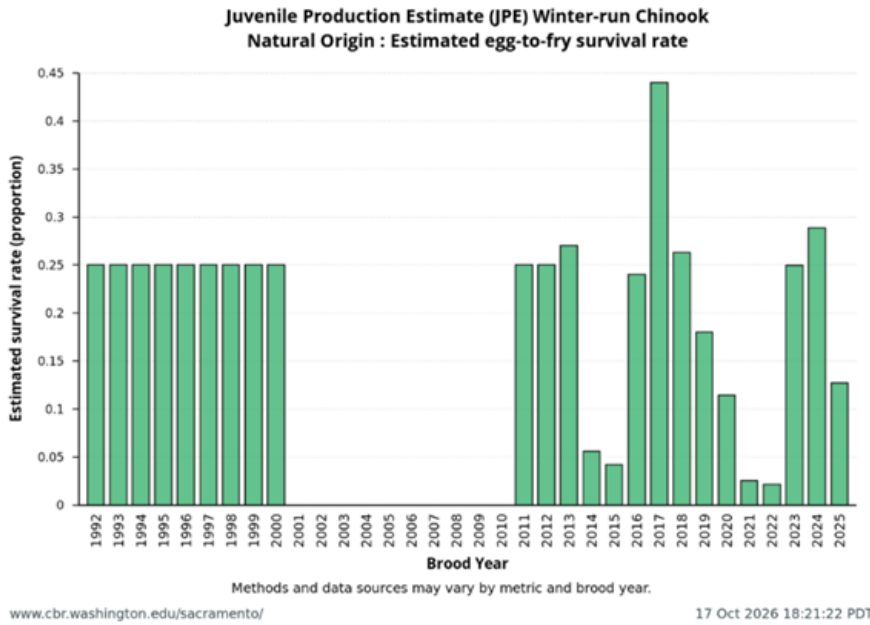


ON THIS PAGE

- Total natural production entering the Delta
- Total Sacramento River escapement
- Adult female estimate (AFE)
- Adult female estimate (AFE) minus pre-spawn mortality
- Average fecundity
- Total eggs
- Estimated egg-to-fry survival rate
- Fry-to-smolt survival
- Estimated smolt survival term
- Number of smolts at RBDD
- Fry equivalents of juvenile production at RBDD
- Natural Incidental Take Limit
- References
- Query Notes

## Estimated egg-to-fry survival rate

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Natural Origin: Estimated egg-to-fry survival rate from annual NMFS Winter-Run Juvenile Production Estimates (JPE)

| Brood Year | Value | Metric | Origin | JPE letter date | Footnote* | References & Contributors | Lower 95% CI | Upper 95% CI |
|---|---|---|---|---|---|---|---|---|
| 2025 | 0.1273 | Estimated egg-to-fry survival rate | Natural | 2026-01-08 | "5/ Back calculated estimated survival between eggs laid in-river and fry production estimates at RBDD based on numbers of fry equivalents (JPI) using the 0.5217 fry-to-smolt survival rate estimate based on method | CDFW, LSNFH, USFWS | NA | NA |

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***JPE Letter data***

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- Total natural production entering the Delta
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Natural Origin: Estimated egg-to-fry survival rate from annual NMFS Winter-Run Juvenile Production Estimates (JPE)

| Brood Year | Value | Metric | Origin | JPE letter date | Footnote* | References & Contributors | Lower 95% CI | Upper 95% CI |
|---|---|---|---|---|---|---|---|---|
| 2025 | 0.1273 | Estimated egg-to-fry survival rate | Natural | 2026-01-08 | "5/ Back calculated estimated survival between eggs laid in-river and fry production estimates at RBDD based on numbers of fry equivalents (JPI) using the 0.5217 fry-to-smolt survival rate estimate based on method described in O'Farrell et al. (2018)." | CDFW, LSNFH, USFWS | NA | NA |
| 2024 | 0.2884 | Estimated egg-to-fry survival rate | Natural | 2025-01-10 | "5/ Back calculated estimated survival between eggs laid in-river and fry production estimates at RBDD based on numbers of fry equivalents (JPI) using the 0.5149 fry-to-smolt survival rate estimate based on method described in O'Farrell et al. (2018)" | CDFW, LSNFH, USFWS | NA | NA |
| 2023 | 0.2494 | Estimated egg-to-fry survival rate | Natural | 2024-01-12 | "5/ Back calculated estimated survival between eggs laid in-river and fry production estimates at RBDD based on numbers of fry equivalents (JPI) using the 0.5066 fry-to-smolt survival rate estimate based on method described in O'Farrell et al. (2018)." | CDFW, LSNFH, USFWS | NA | NA |
| | | | | | "5/ Back calculated estimated survival | | | |

*Winter-run Chinook Salmon Annual BY Assessment Indicators (PA 3.3.3)*



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- Extinction Risk and Population Metrics Definitions
- References

## Winter Chinook Indicators Summary

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Brood Year Assessment Indicators Summary including TDM, ETF, JPE, and Adult Escapement Forecast. Temperature-dependent Mortality (TDM) sourced from SacPAS Fish Model applying Anderson et. al (2022) and Martin et. al (2017) models. Egg-to-fry (ETF) Survival and Natural Origin JPE sourced from annual JPE Letters (compiled by Sac JPE Letter Data). Outyear Adult Escapement Forecast sourced from Table II-2 (PFMC 202

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| Assessment Year | Brood Year | Adult Return Year; BY of Adults | >30% TDM | <20% ETF Survival | 25% JPE (Natural Origin) 3-year Mean | 25% JPE (Natural Origin) 10-year Mean | 25% JPE (Natural Origin) All Years Mean | Outyear Adult Escapement Forecast |
|---|---|---|---|---|---|---|---|---|
| 2025 | 2025 | 2025; 2022 | No | Yes | 115936.8 | 88801.2 | 187527.3 | 4507 |
| 2024 | 2024 | 2024; 2021 | No | No | 31976.1 | 64907.8 | 181189.0 | 1013 |
| 2023 | 2023 | 2023; 2020 | No | No | 34154.8 | 65548.5 | 186236.3 | 4540 |
| 2022 | 2022 | 2022; 2019 | No | Yes | 42091.0 | 89585.8 | 190486.7 | 5971 |
| 2021 | 2021 | 2021; 2018 | Yes | Yes | 109175.8 | 101657.9 | 196624.8 | 9063 |
| 2020 | 2020 | 2020; 2017 | No | Yes | 134853.9 | 102583.2 | 202530.7 | 3077 |
| 2019 | 2019 | 2019; 2016 | No | Yes | 124127.2 | 102630.3 | 206975.1 | 1924 |
| 2018 | 2018 | 2018; 2015 | No | No | 66731.2 | 110747.6 | 206715.1 | 1594 |
| 2017 | 2017 | | No | No | 39109.5 | 115362.8 | 210652.0 | |
| 2016 | 2016 | | No | No | 32702.2 | 122586.1 [b] | 217331.1 | |
| 2015 | 2015 | | Yes | Yes | 118552.0 | 221832.8 [b] | 224973.9 | |

*Winter-run Chinook Salmon Annual BY Assessment Indicators (PA 3.3.3)*

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## Juvenile Production Estimate (JPE)

Annual update to JPE Letter available January/February.

Related SacPAS resource: Juvenile Production Estimates (JPE) for Sacramento River Winter-run Chinook Salmon

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3

Total natural production entering the Delta from annual NMFS Winter-Run Chinook Juvenile Production Estimates (JPE)

| Brood year | Total natural production entering the Delta | JPE Letter Date | JPE Letter References & Contributors | Lower 95% CI | Upper 95% CI | 3-year Mean | 10-year Mean | All Years (to date) Mean | 25% of 3-year Mean | 25% of 10-year Mean | 25% of All Years (to date) Mean |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2025 | 1057452 | 2026-01-08 | Method 2 (O'Farrell et. al 2018) with data from USFWS, UC Santa Cruz, and SWFSC | NA | NA | 463747 | 355204.8 | 750109.0 | 115936.8 | 88801.2 | 187527.3 |
| 2024 | 98893 | 2025-01-10 | Method 2 (O'Farrell et. al 2018) with data from USFWS, UC Santa Cruz, and SWFSC | NA | NA | 127904.3 | 259631.2 | 724756.0 | 31976.1 | 64907.8 | 181189.0 |
| 2023 | 234896 | 2024-01-12 | Method 2 (O'Farrell et. al 2018) with data from USFWS, UC Santa Cruz, and SWFSC | 159951 | 309841 | 136619.3 | 262194 | 744945.2 | 34154.8 | 65548.5 | 186236.3 |
| | | | Method 2 | | | | | | | | |

***JPE Letter data***

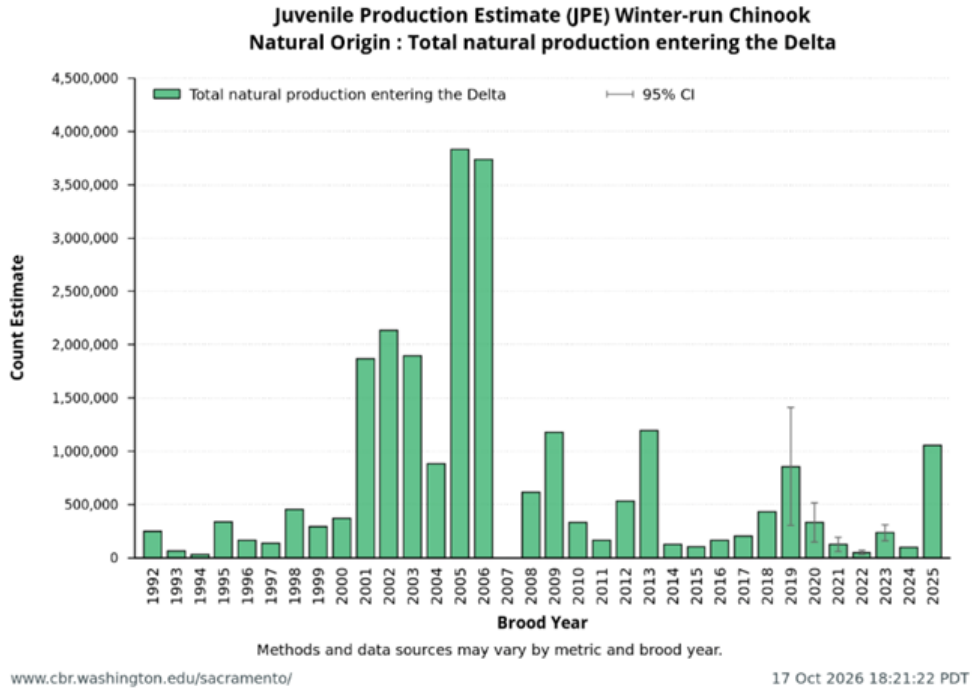
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- Total eggs
- Estimated egg-to-fry survival rate
- Fry-to-smolt survival
- Estimated smolt survival term
- Number of smolts at RBDD
- Fry equivalents of juvenile production at RBDD
- Natural Incidental Take Limit
- References
- Query Notes

## Total natural production entering the Delta

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**Natural Origin: Total natural production entering the Delta from annual NMFS Winter-Run Juvenile Production Estimates (JPE)**

| Brood Year | Value | Metric | Origin | JPE letter date | Footnote | References & Contributors | Lower 95% CI | Upper 95% CI |
|---|---|---|---|---|---|---|---|---|
| 2025 | 1,057,452 | Total natural production entering the Delta | Natural | 2026-01-08 | NA | Method 2 (O'Farrell et al 2018) with data from USFWS, UC Santa Cruz, and SWFSC | NA | NA |

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**JPE Letter data**

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- Estimated smolt survival term
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Natural Origin: Total natural production entering the Delta from annual NMFS Winter-Run Juvenile Production Estimates (JPE)

| Brood Year | Value | Metric | Origin | JPE letter date | Footnote | References & Contributors | Lower 95% CI | Upper 95% CI |
|---|---|---|---|---|---|---|---|---|
| 2025 | 1,057,452 | Total natural production entering the Delta | Natural | 2026-01-08 | NA | Method 2 (O'Farrell et al 2018) with data from USFWS, UC Santa Cruz, and SWFSC | NA | NA |
| 2024 | 98,893 | Total natural production entering the Delta | Natural | 2025-01-10 | NA | Method 2 (O'Farrell et al 2018) with data from USFWS, UC Santa Cruz, and SWFSC | NA | NA |
| 2023 | 234,896 | Total natural production entering the Delta | Natural | 2024-01-12 | NA | Method 2 (O'Farrell et al 2018) with data from USFWS, UC Santa Cruz, and SWFSC | 159,951 | 309,841 |
| 2022 | 49,924 | Total natural production entering the Delta | Natural | 2023-01-13 | NA | Method 2 (O'Farrell et al 2018) with data from USFWS, UC Santa Cruz, and SWFSC | 32,298 | 67,550 |
| 2021 | 125,038 | Total natural production entering the Delta | Natural | 2022-01-14 | NA | Method 2 (O'Farrell et al 2018) with data from USFWS, UC Santa Cruz, and SWFSC | 59,064 | 191,013 |
| | | Total natural | | | | Method 2 (O'Farrell et al | | |

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## Winter Chinook Indicators Summary

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Brood Year Assessment Indicators Summary including TDM, ETF, JPE, and Adult Escapement Forecast. Temperature-dependent Mortality (TDM) sourced from SacPAS Fish Model applying Anderson et. al (2022) and Martin et. al (2017) models. Egg-to-fry (ETF) Survival and Natural Origin JPE sourced from annual JPE Letters (compiled by Sac JPE Letter Data). Outyear Adult Escapement Forecast sourced from Table II-2 (PFMC 202

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| Assessment Year | Brood Year | Adult Return Year; BY of Adults | >30% TDM | <20% ETF Survival | 25% JPE (Natural Origin) 3-year Mean | 25% JPE (Natural Origin) 10-year Mean | 25% JPE (Natural Origin) All Years Mean | Outyear Adult Escapement Forecast |
|---|---|---|---|---|---|---|---|---|
| 2025 | 2025 | 2025; 2022 | No | Yes | 115936.8 | 88801.2 | 187527.3 | 4507 |
| 2024 | 2024 | 2024; 2021 | No | No | 31976.1 | 64907.8 | 181189.0 | 1013 |
| 2023 | 2023 | 2023; 2020 | No | No | 34154.8 | 65548.5 | 186236.3 | 4540 |
| 2022 | 2022 | 2022; 2019 | No | Yes | 42091.0 | 89585.8 | 190486.7 | 5971 |
| 2021 | 2021 | 2021; 2018 | Yes | Yes | 109175.8 | 101657.9 | 196624.8 | 9063 |
| 2020 | 2020 | 2020; 2017 | No | Yes | 134853.9 | 102583.2 | 202530.7 | 3077 |
| 2019 | 2019 | 2019; 2016 | No | Yes | 124127.2 | 102630.3 | 206975.1 | 1924 |
| 2018 | 2018 | 2018; 2015 | No | No | 66731.2 | 110747.6 | 206715.1 | 1594 |
| 2017 | 2017 | | No | No | 39109.5 | 115362.8 | 210652.0 | |
| 2016 | 2016 | | No | No | 32702.2 | 122586.1 [b] | 217331.1 | |
| 2015 | 2015 | | Yes | Yes | 118552.0 | 221832.8 [b] | 224973.9 | |

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## Winter Chinook Indicators Summary

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Brood Year Assessment Indicators Summary including TDM, ETF, JPE, and Adult Escapement Forecast. Temperature-dependent Mortality (TDM) sourced from SacPAS Fish Model applying Anderson et. al (2022) and Martin et. al (2017) models. Egg-to-fry (ETF) Survival and Natural Origin JPE sourced from annual JPE Letters (compiled by SacPAS at JPE Letter Data). Ou
4
Adult Escapement Forecast sourced from Table II-2 (PFMC 2024).

| Assessment Year | Brood Year | Adult Return Year; BY of Adults | >30% TDM | <20% ETF Survival | 25% JPE (Natural Origin) 3-year Mean | 25% JPE (Natural Origin) 10-year Mean | 25% JPE (Natural Origin) All Years Mean | Outyear Adult Escapement Forecast |
|---|---|---|---|---|---|---|---|---|
| 2025 | 2025 | 2025; 2022 | No | Yes | 115936.8 | 88801.2 | 187527.3 | 4507 |
| 2024 | 2024 | 2024; 2021 | No | No | 31976.1 | 64907.8 | 181189.0 | 1013 |
| 2023 | 2023 | 2023; 2020 | No | No | 34154.8 | 65548.5 | 186236.3 | 4540 |
| 2022 | 2022 | 2022; 2019 | No | Yes | 42091.0 | 89585.8 | 190486.7 | 5971 |
| 2021 | 2021 | 2021; 2018 | Yes | Yes | 109175.8 | 101657.9 | 196624.8 | 9063 |
| 2020 | 2020 | 2020; 2017 | No | Yes | 134853.9 | 102583.2 | 202530.7 | 3077 |
| 2019 | 2019 | 2019; 2016 | No | Yes | 124127.2 | 102630.3 | 206975.1 | 1924 |
| 2018 | 2018 | 2018; 2015 | No | No | 66731.2 | 110747.6 | 206715.1 | 1594 |
| 2017 | 2017 | | No | No | 39109.5 | 115362.8 | 210652.0 | |
| 2016 | 2016 | | No | No | 32702.2 | 122586.1 [b] | 217331.1 | |
| 2015 | 2015 | | Yes | Yes | 118552.0 | 221832.8 [b] | 224973.9 | |

*Winter-run Chinook Salmon Annual BY Assessment Indicators (PA 3.3.3)*



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## Outyear Adult Escapement Forecast

Annual updates to Adult Escapement Forecast estimates available February/March.

Related SacPAS resource: SacPAS webpage for PFMC Abundance, Harvest, and Impact Rates

download Table II-2 CSV

Table II-2 Sacramento [4] winter Chinook abundance forecasts, allowable age-3 impact rates, and management perform (reproduced from PFMC 2026a)

| Year [a] | 3-Year Geometric Mean [b] | Abundance Forecast [c] | Postseason Abundance [d] | Postseason Abundance Value Footnote | Age-3 impact rate south of Point Arena, CA | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Maximum Allowable (%) [e] | Preseason Forecast (%) | Postseason Estimate (%) | Postseason Estimate Value Footnote |
| **2026** [i] | | 9883 | | f | 20.0 | NA | NA | |
| **2025** | | 4507 | | f | 20.0 | 1.6 | NA | |
| **2024** | | 1013 | | f | 12.1 | — | — | |
| **2023** | | 4540 | | f | 20.0 | 0.0 | NA | h |
| **2022** | | 5971 | 3071 | | 20.0 | 15.2 | 26.2 | g |
| **2021** | | 9063 | 6346 | | 20.0 | 14.7 | 18.8 | |
| **2020** | | 3077 | 10854 | | 20.0 | 16.2 | 12.6 | |
| **2019** | | 1924 | 6935 | | 15.7 | 14.8 | 10.0 | |
| **2018** | | 1594 | 8139 | | 14.4 | 8.5 | 13.9 | |
| **2017** | 2521 | | 2117 | | 15.8 | 12.2 | 17.6 | |
| **2016** | 3981 | | 508 | | 19.9 | 12.8 | 10.7 | |
| **2015** | 3659 | | 867 | | 19.0 | 17.5 | | e |
| **2014** | 2380 | | 3718 | | 15.4 | 15.4 | 15.8 | |
| **2013** | 1521 | | 3067 | | 12.9 | 12.9 | 18.8 | |
| **2012** | 1797 | | 5960 | | 13.7 | 13.7 | 12.6 | |
| **2011** | | | 3263 | | | | 28.3 | |

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- Hydrologic Classification Indices

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- Carcass Detail
- Aerial Redd
- Redd Dewatering
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# PFMC Abundance, Harvest, and Impact Rates

Harvest and Impact Rates | Escapement Estimates

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Table II-2 Sacramento River winter Chinook abundance forecasts, allowable age-3 impact rates, and management performance (reproduced from PFMC 2026a)

| Year [a] | 3-Year Geometric Mean [b] | Abundance Forecast [c] | Postseason Abundance [d] | Postseason Abundance Value Footnote | Age-3 impact rate south of Point Arena, CA | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Maximum Allowable (%) [e] | Preseason Forecast (%) | Postseason Estimate (%) | Postseason Estimate Value Footnote |
| **2026** [i] | | 9883 | | f | 20.0 | NA | NA | |
| **2025** | | 4507 | | f | 20.0 | 1.6 | NA | |
| **2024** | | 1013 | | f | 12.1 | — | — | |
| **2023** | | 4540 | | f | 20.0 | 0.0 | NA | h |
| **2022** | | 5971 | 3071 | | 20.0 | 15.2 | 26.2 | g |
| **2021** | | 9063 | 6346 | | 20.0 | 14.7 | 18.8 | |
| **2020** | | 3077 | 10854 | | 20.0 | 16.2 | 12.6 | |
| **2019** | | 1924 | 6935 | | 15.7 | 14.8 | 10.0 | |
| **2018** | | 1594 | 8139 | | 14.4 | 8.5 | 13.9 | |
| **2017** | 2521 | | 2117 | | 15.8 | 12.2 | 17.6 | |
| **2016** | 3981 | | 508 | | 19.9 | 12.8 | 10.7 | |
| **2015** | 3659 | | 867 | | 19.0 | 17.5 | | e |
| **2014** | 2380 | | 3718 | | 15.4 | 15.4 | 15.8 | |
| **2013** | 1521 | | 3067 | | 12.9 | 12.9 | 18.8 | |
| **2012** | 1797 | | 5960 | | 13.7 | 13.7 | 12.6 | |

# Following what is in Proposed Action of LTO BA (Oct 2024), Section 3.3.3

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**Chapter 3 – Proposed Action**

**3.3.3 Annual Winter-run Chinook Salmon Broodyear Assessment**

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2. <20% ETF survival
3. 25% of historic JPE
   - TMP compliance point was above CCR
   - Adverse Population Viability Trends (per previous year's annual brood year report if there was an increase in any of the five criteria in Lindley et. al. 2007)
   - High Risk of Extinction (per 5 year status review)
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## 5 Temperature Compliance Point (TCP)

Related SacPAS resource: Sacramento River Water Temperature Threshold Analysis

Sacramento River Historical Temperature Control Point 2010-2018 Daily Average Temperature Degrees Fahrenheit (Days Applied) from SRTTG annual report Original SRTTG Annual Report Table 3 (https://cawaterlibrary.net/wp-content/uploads/2020/06/FINAL_SRTTG_2018_Annual_Report_20181121.pdf) Updated by SacPAS. CDEC Sites BSF = Balls Ferry, JLF = Jellys Ferry, CCR = Sacramento River upstream of Clear Creek confluence, and SAC = Sacramento River upstream of Hwy 44.

| Year | March | April | May | June | July | August | September | October | November |
|---|---|---|---|---|---|---|---|---|---|
| 2025 [5] | CCR-58°F | CCR-58°F | CCR-58.0°F (01-14); CCR-53.5°F (15-31) | CCR-53.5°F | CCR-53.5°F | CCR-53.5°F | CCR-53.5°F | CCR-53.5°F | |
| 2024 [5] | CCR-53.5°F | CCR-53.5°F | CCR-53.5°F | CCR-53.5°F | CCR-53.5°F | CCR-53.5°F | CCR-53.5°F | CCR-53.5°F | CCR-53.5°F |
| 2023 [5] | SAC-54.5°F | SAC-54.5°F | SAC-54.5°F (01-13); CCR-53.5°F (14-31) | CCR-53.5°F | CCR-53.5°F | CCR-53.5°F | CCR-53.5°F | CCR-53.5°F | CCR-53.5°F |
| 2022 [5] | SAC-55°F | SAC-55°F | SAC-55°F (01-01); SAC-58°F (02-31) | SAC-58°F (01-06); SAC-54.5°F (07-30) | SAC-54.5°F | SAC-54.5°F | SAC-54.5°F | SAC-54.5°F | SAC-54.5°F |
| 2021 [5] | CCR-56°F | CCR-56°F (01-17); CCR-60°F (18-30) | CCR-60°F (01-16); SAC-57°F (17-31) | SAC-57°F (01-14); SAC-55°F (15-30) | SAC-55°F | SAC-55°F | SAC-55°F | SAC-55°F | SAC-55°F |
| 2020 [5] | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F (01-20); CCR-56°F (21-30) | CCR-56°F | CCR-56°F |
| 2019 [5] | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F |
| 2018 [4] | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F |
| 2017 [3] | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F | BSF-56°F |

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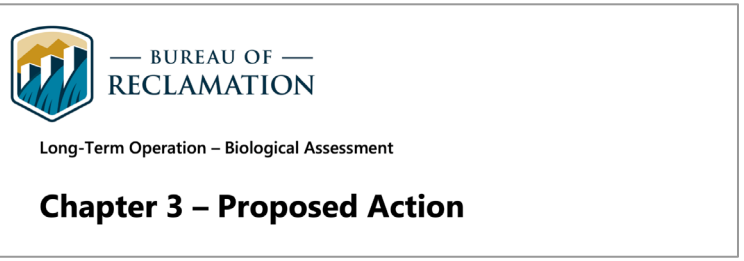
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SAN FRANCISCO ESTUARY & WATERSHED SCIENCE
Published by the California Bay-Delta Authority Science Program and the John Muir Institute of the Environment

# Framework for Assessing Viability of Threatened and Endangered Chinook Salmon and Steelhead in the Sacramento-San Joaquin Basin

**Steven T. Lindley*, National Oceanic and Atmospheric Administration**

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**Bernard P. May, University of California, Davis**

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**Christina Swanson, The Bay Institute**

**John G. Williams, independent consultant**

***Corresponding author:** steve.lindley@noaa.gov

(Lindley et al. 2007)

**Table 1.** Criteria for assessing the level of risk of extinction for populations of Pacific salmonids. Overall risk is determined by the highest risk score for any category. (Modified from Allendorf et al. 1977)

| | Risk of Extinction | | |
|---|---|---|---|
| Criterion | High | Moderate | Low |
| Extinction risk from PVA | > 20% within 20 years | > 5% within 100 years | < 5% within 100 years |
| | – or any ONE of – | – or any ONE of – | – or ALL of – |
| Population size[a] | $N_e \leq 50$ | $50 < N_e \leq 500$ | $N_e > 500$ |
| | –or– | –or– | –or– |
| | $N \leq 250$ | $250 < N \leq 2500$ | $N > 2500$ |
| Population decline | Precipitous decline[b] | Chronic decline or depression[c] | No decline apparent or probable |
| Catastrophe, rate and effect[d] | Order of magnitude decline within one generation | Smaller but significant decline[e] | not apparent |
| Hatchery influence[f] | High | Moderate | Low |

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(Lindley et al. 2007)

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## Extinction Risk

Direct quote from NMFS 2024, p17.

**Updated Biological Risk Summary**

The biological status of the SR winter-run Chinook salmon population has declined since the 2016 5-year review, with the single spawning population on the mainstem Sacramento River at a high risk of extinction (Table 7). New information indicates the population – which had experienced a declining trend in abundance through 2017 – is beginning to rebuild such that the population decline viability criteria would indicate a low risk of extinction for SR winter-run Chinook salmon. The population, however, remains at an increased risk of extinction due to the influence of the hatchery broodstock. Although at the time of this review hatchery influence is declining, it remains at a level above which would indicate a low or moderate extinction risk.

**Table 7. Summary of SR winter-run Chinook salmon extinction risk by population criteria described in Lindley et al. (2007) for the 2010, 2015, and 2020 review periods. Overall risk is determined by the highest risk score for any criterion.**

| Criteria | 2011 5-Year Review | 2016 5-Year Review | 2024 5-Year Review |
|---|---|---|---|
| **Population Size** | Low risk | Low risk | Low risk |
| **Population Decline** | Low risk | Moderate risk | Low risk |
| **Catastrophe, rate and effect** | Low risk | Low risk | Low risk |
| **Hatchery Influence** | Low risk | Moderate risk | High risk |

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**Overall risk is determined by the highest risk score for any criterion (NMFS 2024).**

| | 2011 5-Year Review | 2016 5-Year Review | 2024 5-Year Review |
|---|---|---|---|
| **Extinction Risk** | Low risk | Moderate risk | **High risk** |

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## PA 3.3.3 Quoted Text

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Direct quote from Reclamation 2024, pp 3-25 to 3-26.

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| **Population size**[a] | $N_e \leq 50$<br>–or–<br>$N \leq 250$ | $50 < N_e \leq 500$<br>–or–<br>$250 < N \leq 2500$ | $N_e > 500$<br>–or–<br>$N > 2500$ |
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| **Hatchery influence**[f] | High | Moderate | Low |

a. Census size $N$ can be used if direct estimates of effective size $N_e$ are not available, assuming $N_e/N = 0.2$.
b. Decline within last two generations to annual run size ≤ 500 spawners, or run size > 500 but declining at ≥ 10% per year. Historically small but stable population not included.
c. Run size has declined to ≤ 500, but now stable.
d. Catastrophes occurring within the last 10 years.
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Direct quote from Lindley et al. 2007, Table 2.

**Table 2. Estimation methods and data requirements for population metrics. $S_t$ denotes the number of spawners in year $t$; $g$ is mean generation time, which we take as three years for California salmon.**

| Metric | Estimator | Data | Criterion |
|---|---|---|---|
| $\hat{S}_t$ | $\sum_{i=t-g+1}^{t} S_i/g$ | ≥ 3 years spawning run estimates | Population decline |
| $N_e$ | $N \times 0.2$ or other | varies | Population size |
| $N$ | $\hat{S}_t \times g$ | ≥ 3 years spawning run estimates | Population size |
| Population growth rate (% per year) | slope of $\log(S_t)$ v. time $\times 100$ | 10 years $S_t$ | Population decline |
| $c$ | $100 \times (1 - \min(N_{t+g}/N_t))$ | time series of $N$ | Catastrophe |
| $h$ | average fraction of natural spawners of hatchery origin | mean of 1-4 generations | Hatchery influence |

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- References


## References


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Anderson, J.J., W.N. Beer, J.A. Israel, S. Greene. 2022. Targeting River Operations to the Critical Thermal Window of Fish Incubation: Model and Case Study on Sacramento River Winter-Run Chinook Salmon. River Research and Applications 8950: 895-905.

Lindley, S.T. et al. 2007. Framework for Assessing Viability of Threatened and Endangered Chinook Salmon and Steelhead in The Sacramento-San Joaquin Basin. Vol. 5, Issue 1 [February 2007]. Article 4.

Martin, B.T., A. Pike, S.N. John, N. Hamda, J. Roberts, S.T. Lindley, and E.M. Danner. 2017. Phenomenological vs. Biophysical Models of Thermal Stress in Aquatic Eggs. Ecology Letters 20(1):50-59.

NMFS (National Marine Fiseries Service). 2024. 2024 5-Year Review: Summary & Evaluation of Sacramento River Winter-Run Chinook Salmon. West Coast Region, National Marine Fiseries Service.

PFMC (Pacific Fishery Management Council). 2025a. Preseason Report I: Stock Abundance Analysis and Environmental Assessment Part 1 for 2025 Ocean Salmon Fishery Regulations. (Document prepared for the Council and its advisory entities.) Pacific Fishery Management Council, 7700 NE Ambassador Place, Suite 101, Portland, Oregon 97220-1384.

Reclamation 2024. Long-Term Operation of the Central Valley Project and State Water Project Central Valley Project, California Mid-Pacific Region, Final EIS - Appendix AB - Biological Assessment - Chapter 3 Proposed Actions. pp 3-25, 3-26.

# Three major tools for the Delta Actions Team (DAT)

1) Track-a-Cohort

   Tracking a cohort with real-time (near-real-time) data through the life stages and in context of historical data

2) Real-Time Assessments

   Weekly assessments inform risk for ESA-listed species

3) Annual Brood Year Assessment Indicators

   Previous BY's cohort of outmigrants and adult returns from BY 3 y ago; inform operations, risk tradeoffs for water temperature management and need for increased production, etc.

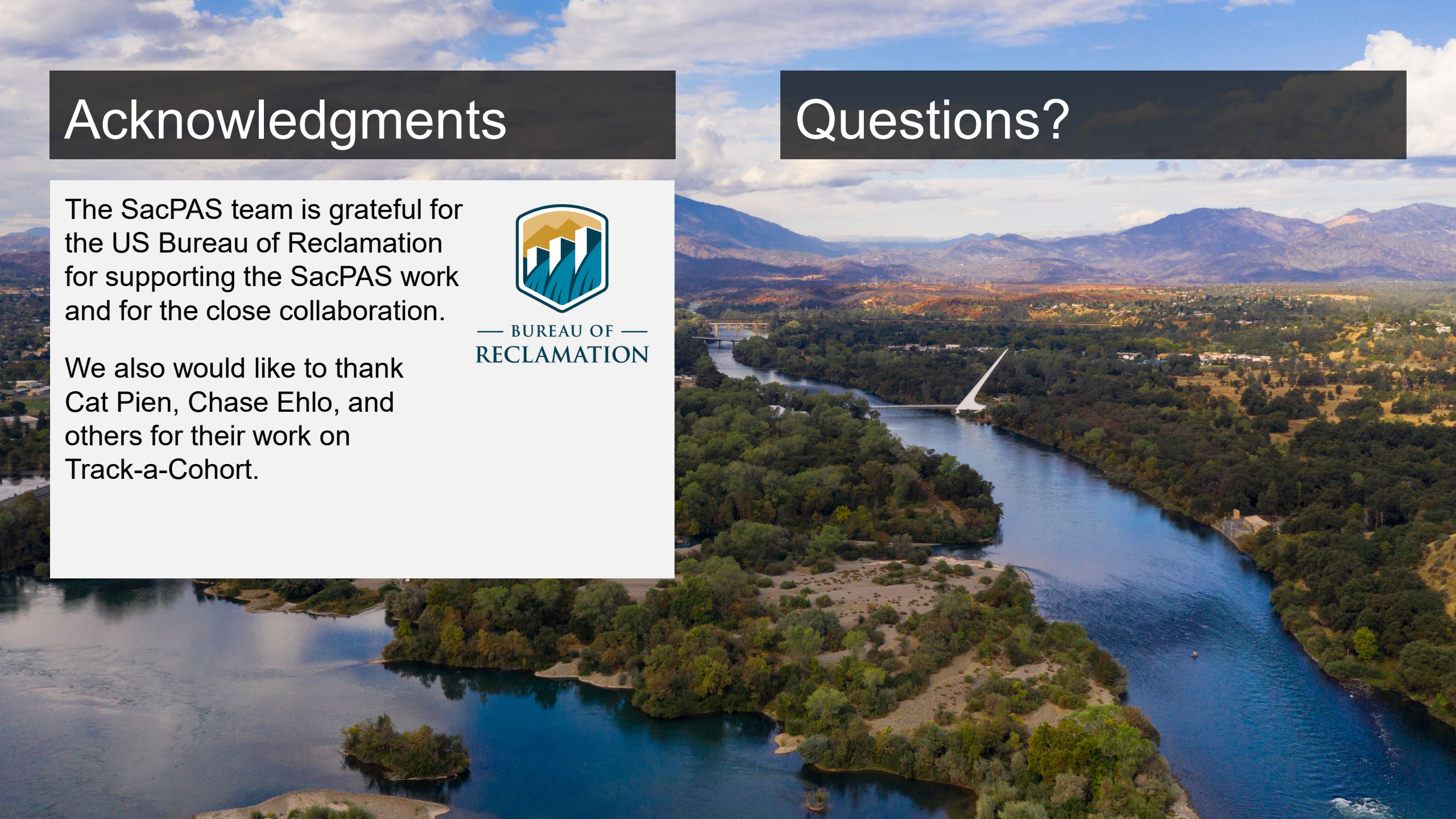
# Acknowledgments

The SacPAS team is grateful for the US Bureau of Reclamation for supporting the SacPAS work and for the close collaboration.

We also would like to thank Cat Pien, Chase Ehlo, and others for their work on Track-a-Cohort.

BUREAU OF RECLAMATION

# Questions?



# EXTRA SLIDES

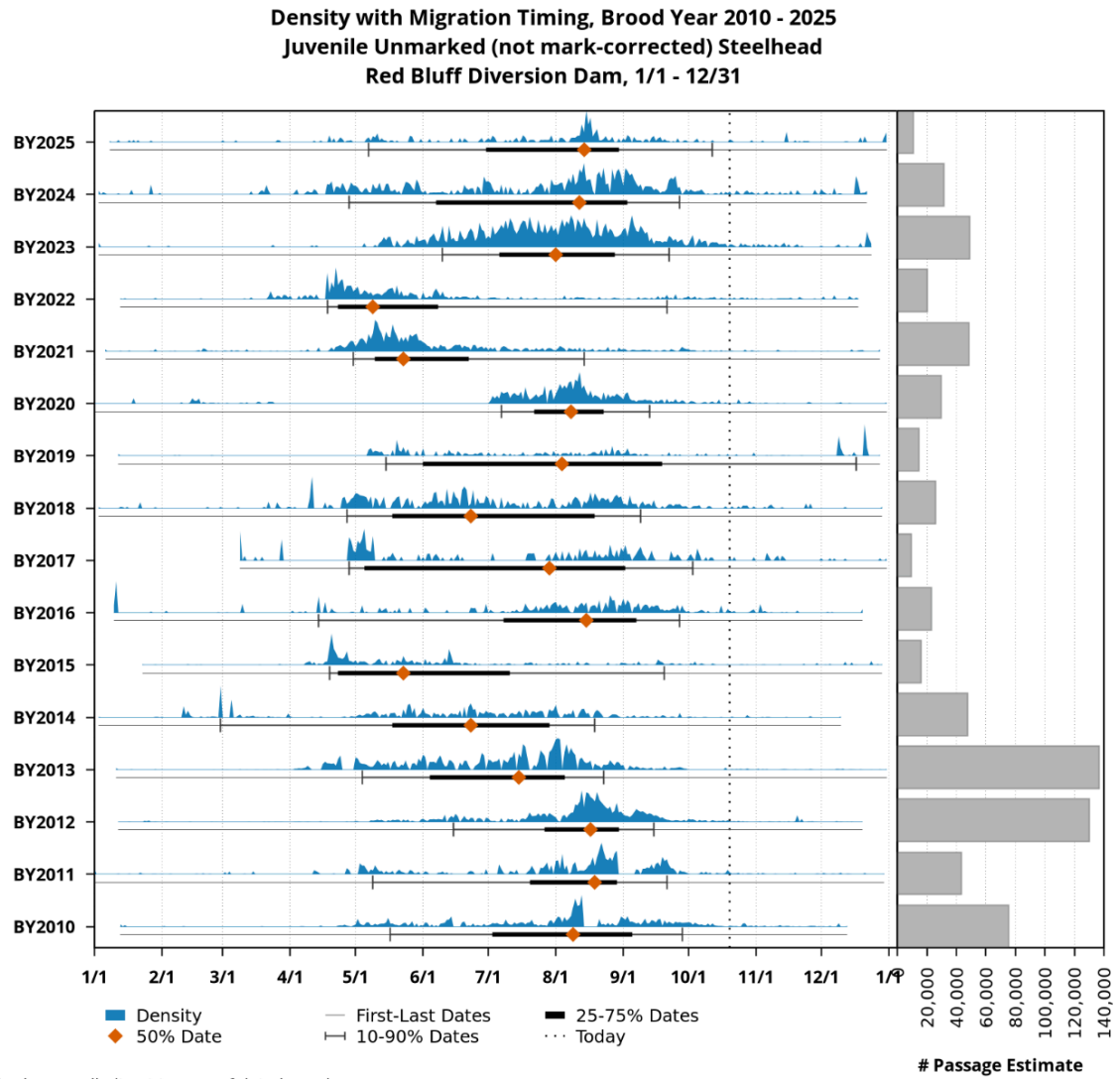
# Track-a-Cohort - Steelhead

ON THIS PAGE

Juveniles in River ▼
- Migration Timing — annual data
- Today Percent
- Current Catch

Juveniles in Delta ▶
Adults in Ocean ▶
Adults in River

# Migration Timing — annual data




Y-axis upper limit set to max of data in each year.
Based on Daily Estimated Passage; method updated BY2020. Preliminary data from USFWS Red Bluff; subject to revision.
No sampling 2020-03-25 to 2020-06-30.

ON THIS PAGE

Juveniles in River ▼

Migration Timing — annual data

Today Percent

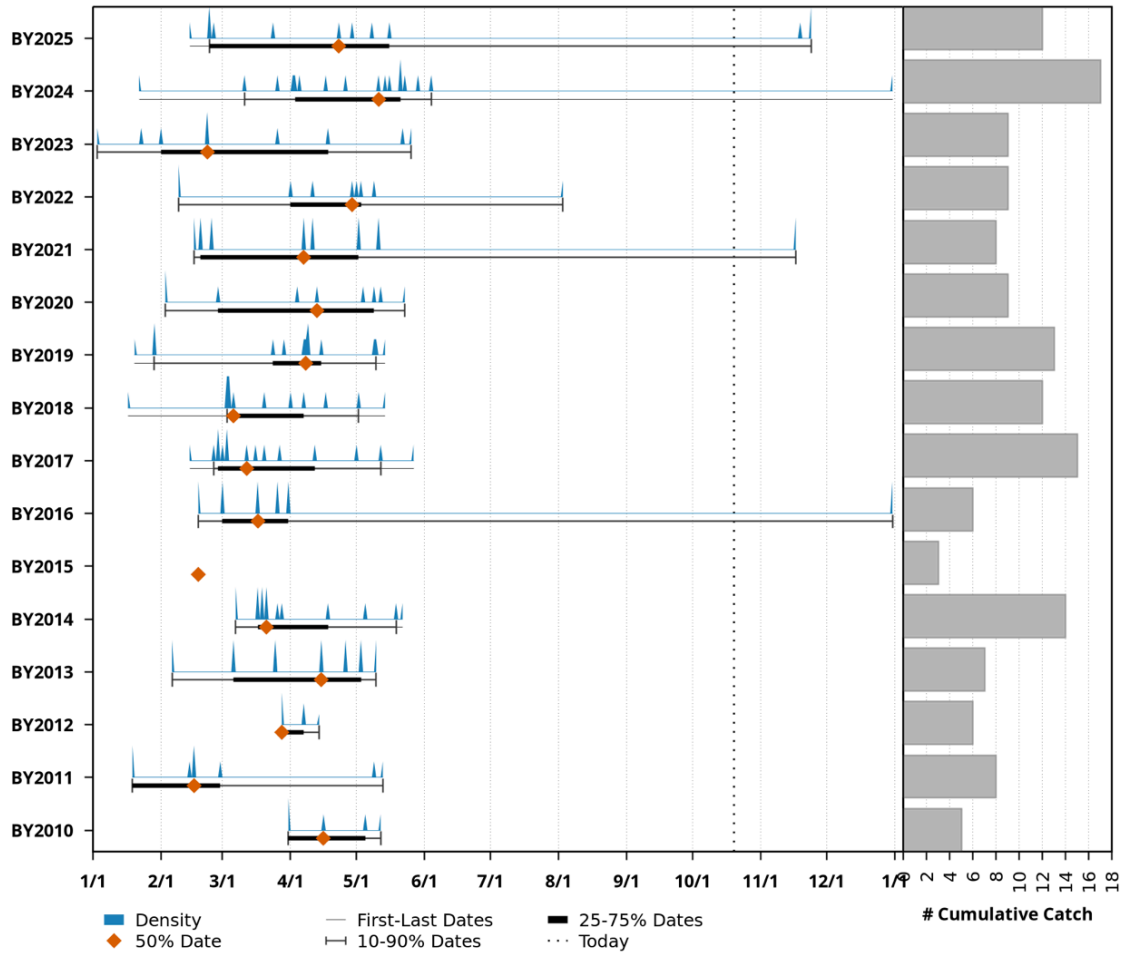
Current Catch

Juveniles in Delta ▶

Adults in Ocean ▶

Adults in River

**Density with Migration Timing, Brood Year 2010 - 2025**
**Juvenile Unclipped Steelhead**
**Chipps Island Trawls (Raw Catch), 1/1 - 12/31**




Y-axis upper limit set to max of data in each year.
Based on Raw Catch. Preliminary data from USFWS Lodi; subject to revision.

www.cbr.washington.edu/sacramento/ • 21 Oct 2026 11:15:25 PDT

Related Query

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Juveniles in River
- Migration Timing — annual data
- Today Percent
- Current Catch

Juveniles in Delta
Adults in Ocean
Adults in River

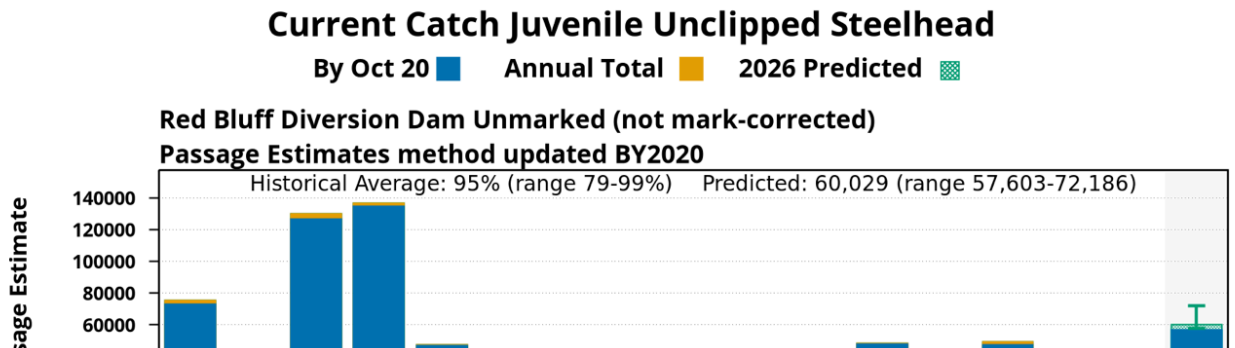
## Today Percent

**Average Percent by 10/20, with 95%CI, of annual emigrating population for juveniles of each species of interest captured at the following locations and salvaged at SWP and CVP Delta facilities**

| Species | Red Bluff Diversion Dam | Tisdale RST | Knights Landing RST | Sac Trawl (Sherwood) Catch Index | Chipps Island Trawl Catch Index | Salvage |
|---|---|---|---|---|---|---|
| Steelhead, Unclipped (January-December) | | | | | | |
| Steelhead, Unclipped (Water Year) | | | | | | 0.0% (0.0%,0.0%) WY: 2017 - 2026 |

Calculations generated by SacPAS Migration Timing and Conditions by Cohort and Salvage Timing.
Data Courtesy of USFWS, Red Bluff; CDFW via StreamNet and CDEC; USFWS, Lodi.

## Current Catch



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Juveniles in River ▼

Migration Timing — annual data

Today Percent

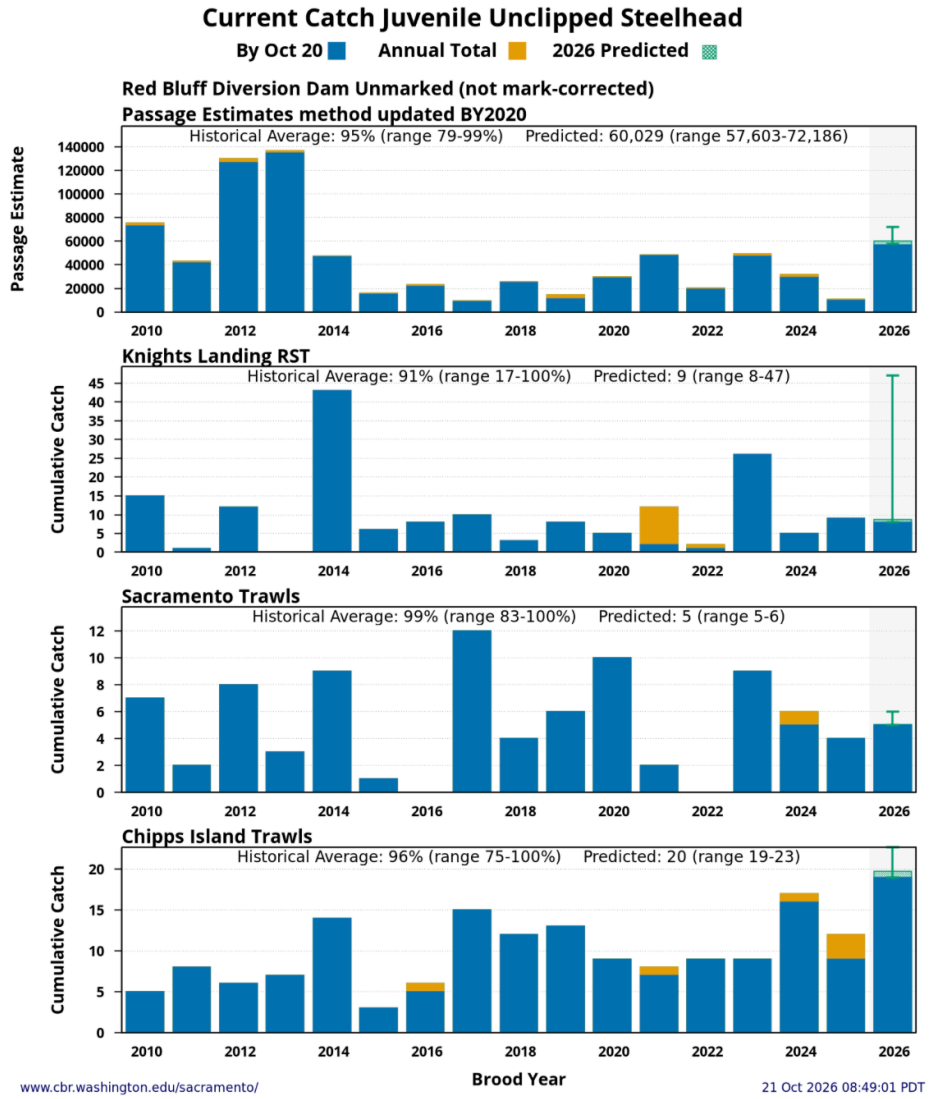
Current Catch

Juveniles in Delta ▶

Adults in Ocean ▶

Adults in River

## Current Catch



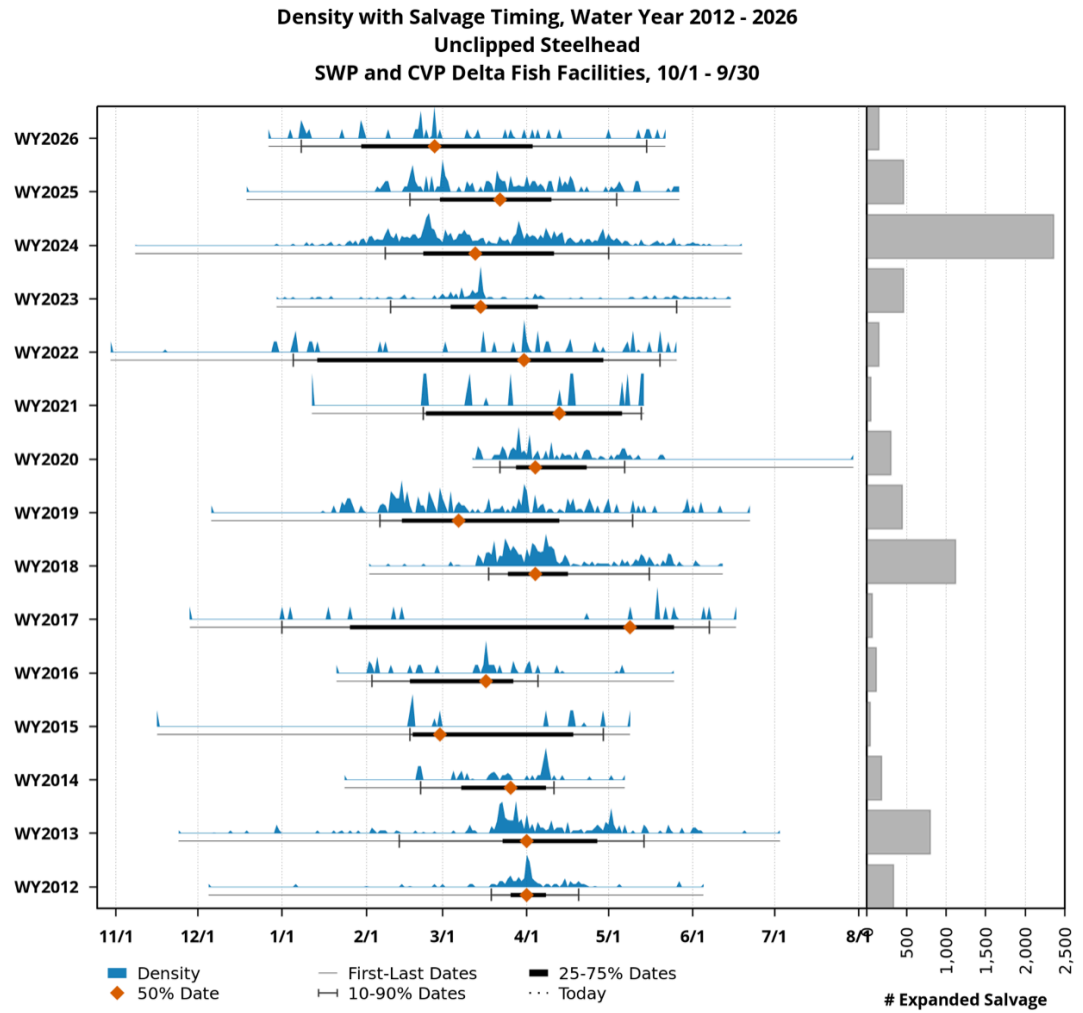

Related Query

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Adults in River

# Juveniles in Delta

## Salvage Timing — annual data




Y-axis upper limit set to max of data in each year.
www.cbr.washington.edu/sacramento/

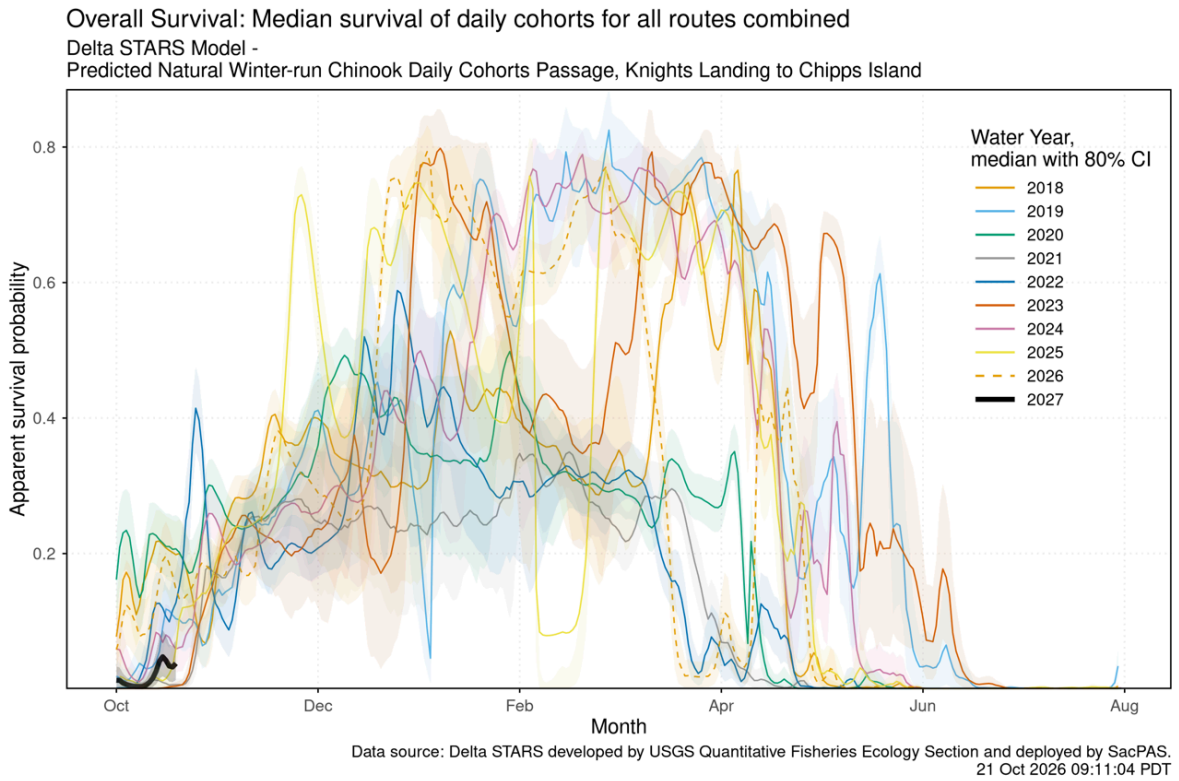
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# Delta STARS Survival and Routing Probabilities

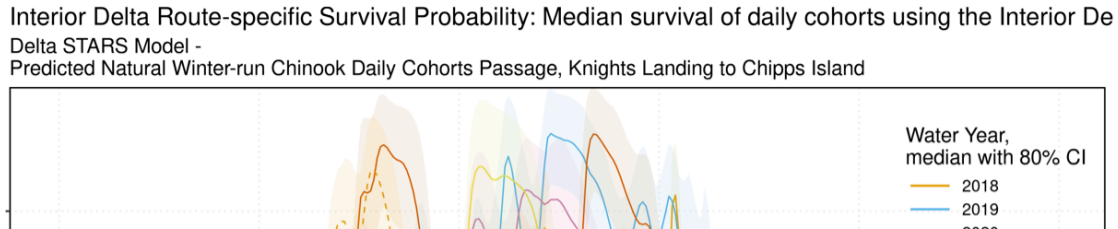
## Winter-run Chinook presented as surrogate for Steelhead

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- Adults in River

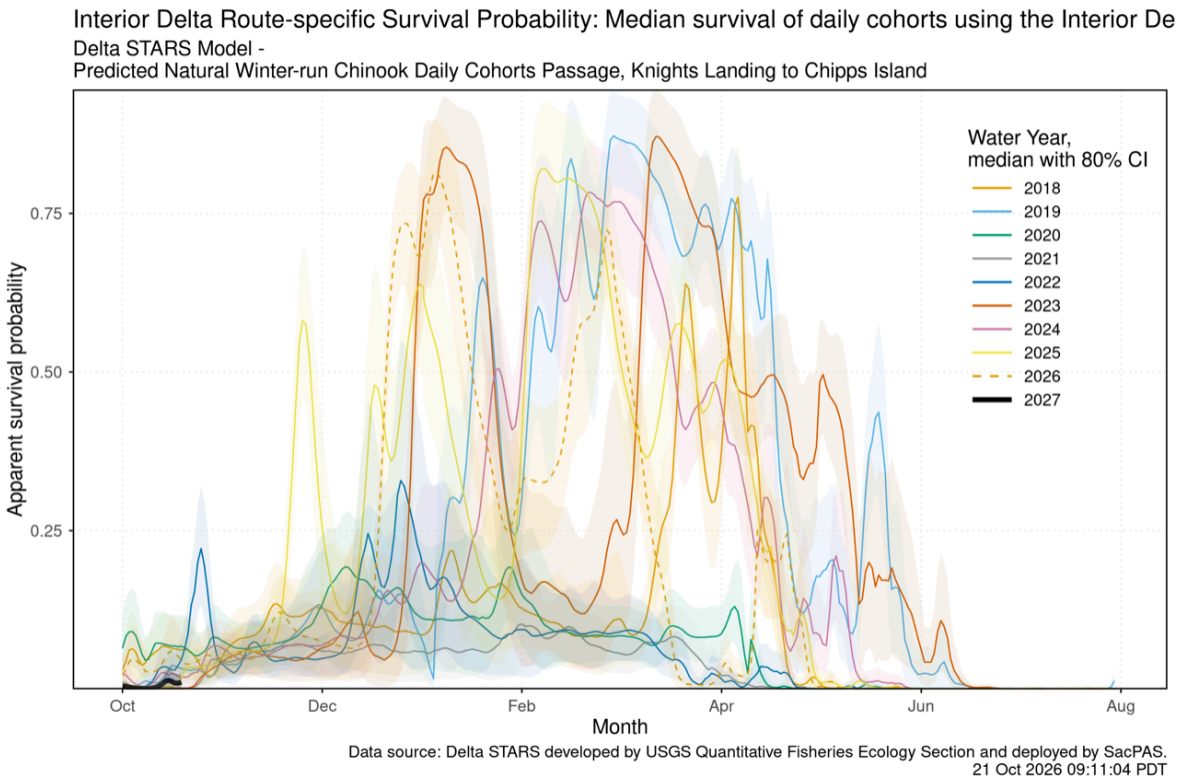



**Winter-run Chinook as surrogate for Steelhead**

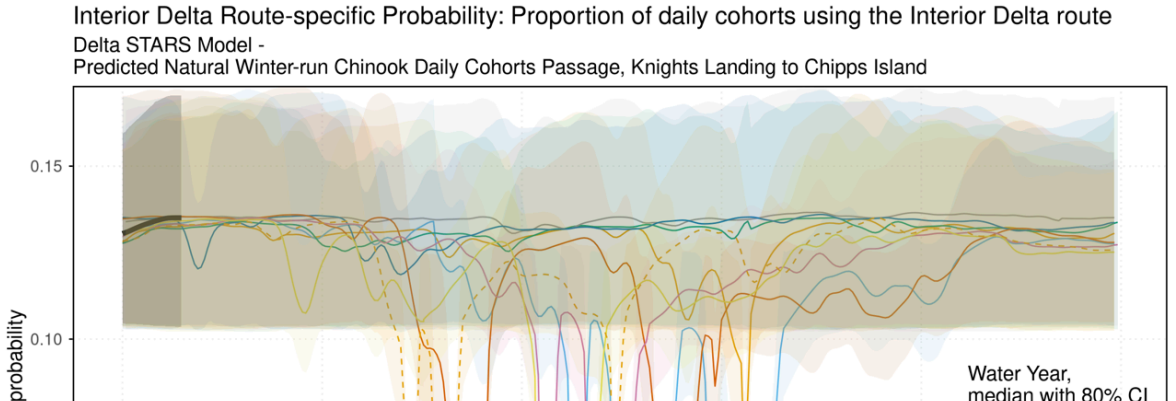


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**Winter-run Chinook as surrogate for Steelhead**

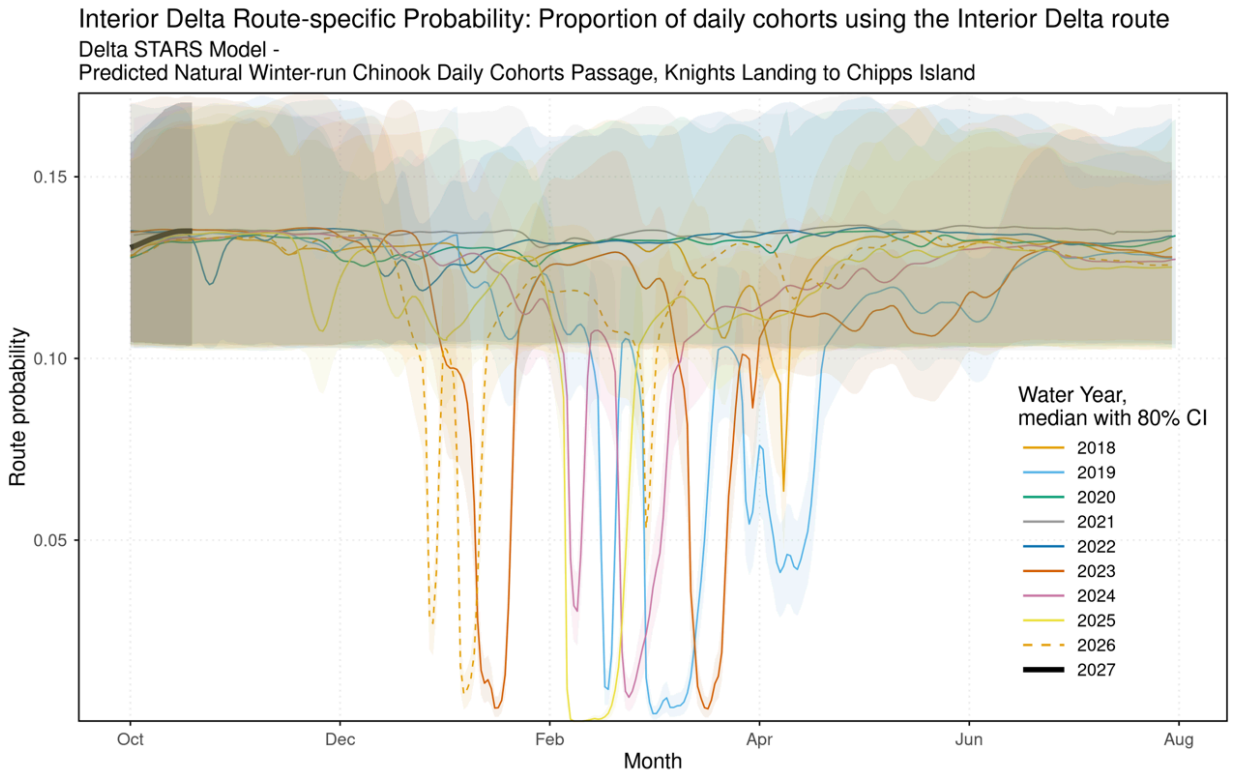


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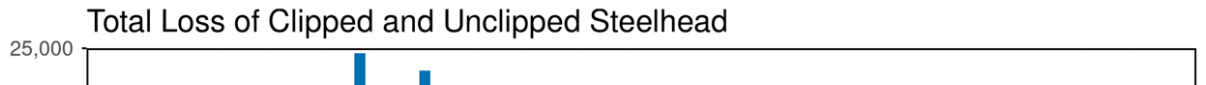
Adults in Ocean ▶




**Winter-run Chinook as surrogate for Steelhead**

GitHub Repo | STARS ShinyApp

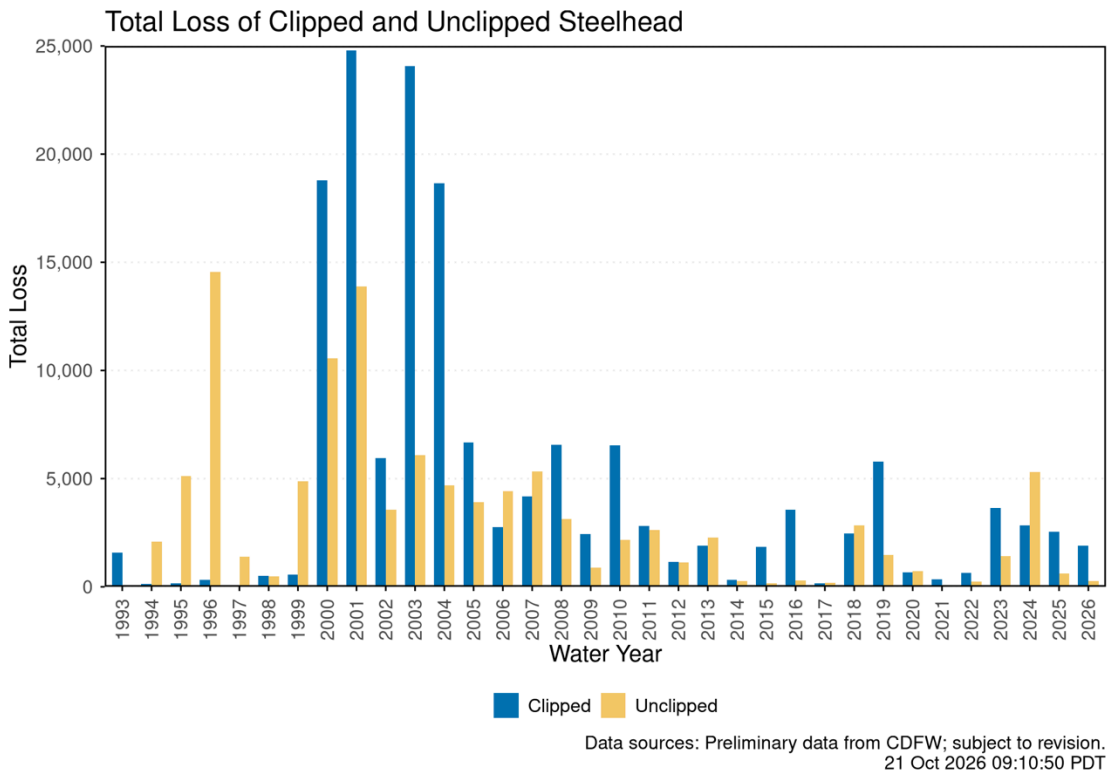
## Total Loss — Clipped and Unclipped Steelhead



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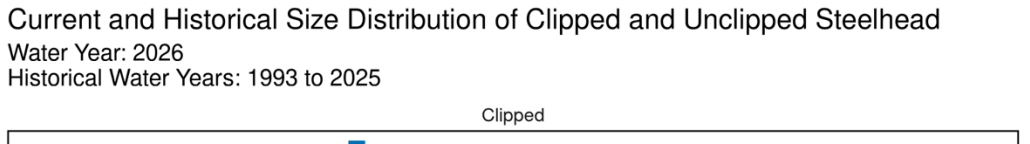
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## Total Loss — Clipped and Unclipped Steelhead




GitHub Repo | Related Query

## Size (Fork Length) Distribution of Steelhead Loss, Combined



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- Adults in River

## Size (Fork Length) Distribution of Steelhead Loss, Combined

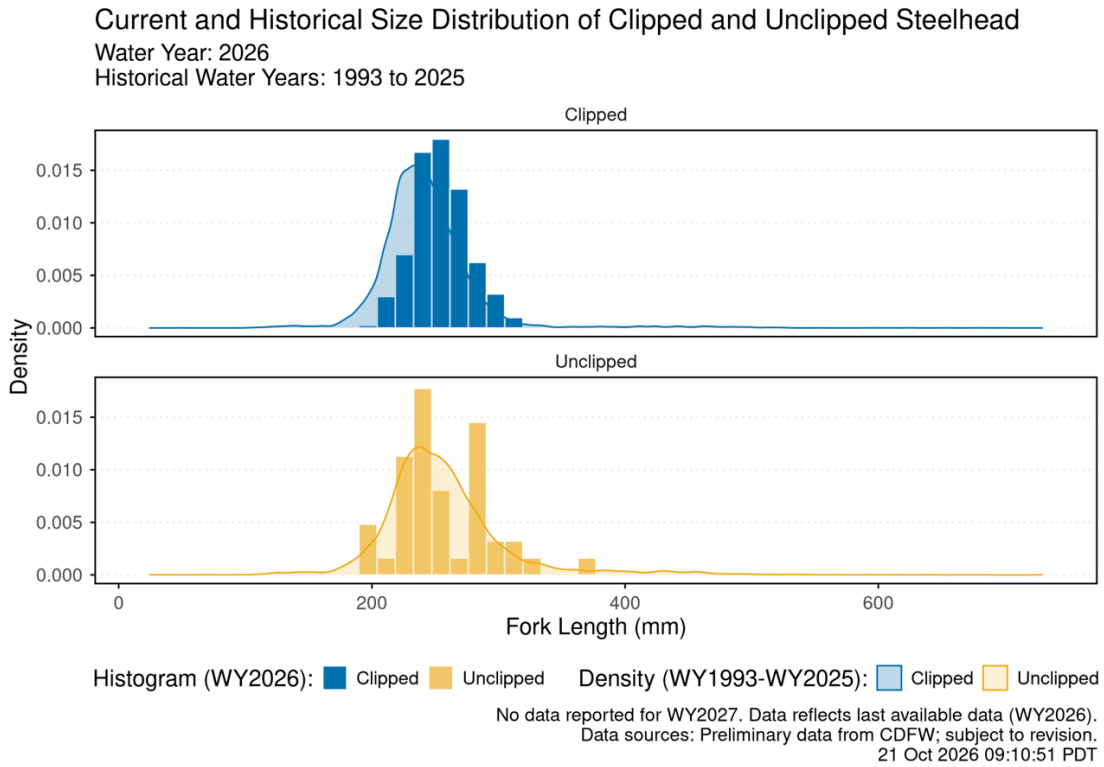



**Figure compares density plots that highlight historical (WY1994 to WY2023) size distribution and histogram of current year (WY2024) size distribution by rear type (yellow = unclipped; blue = clipped). Fork lengths below 750 mm were included in dataset.**

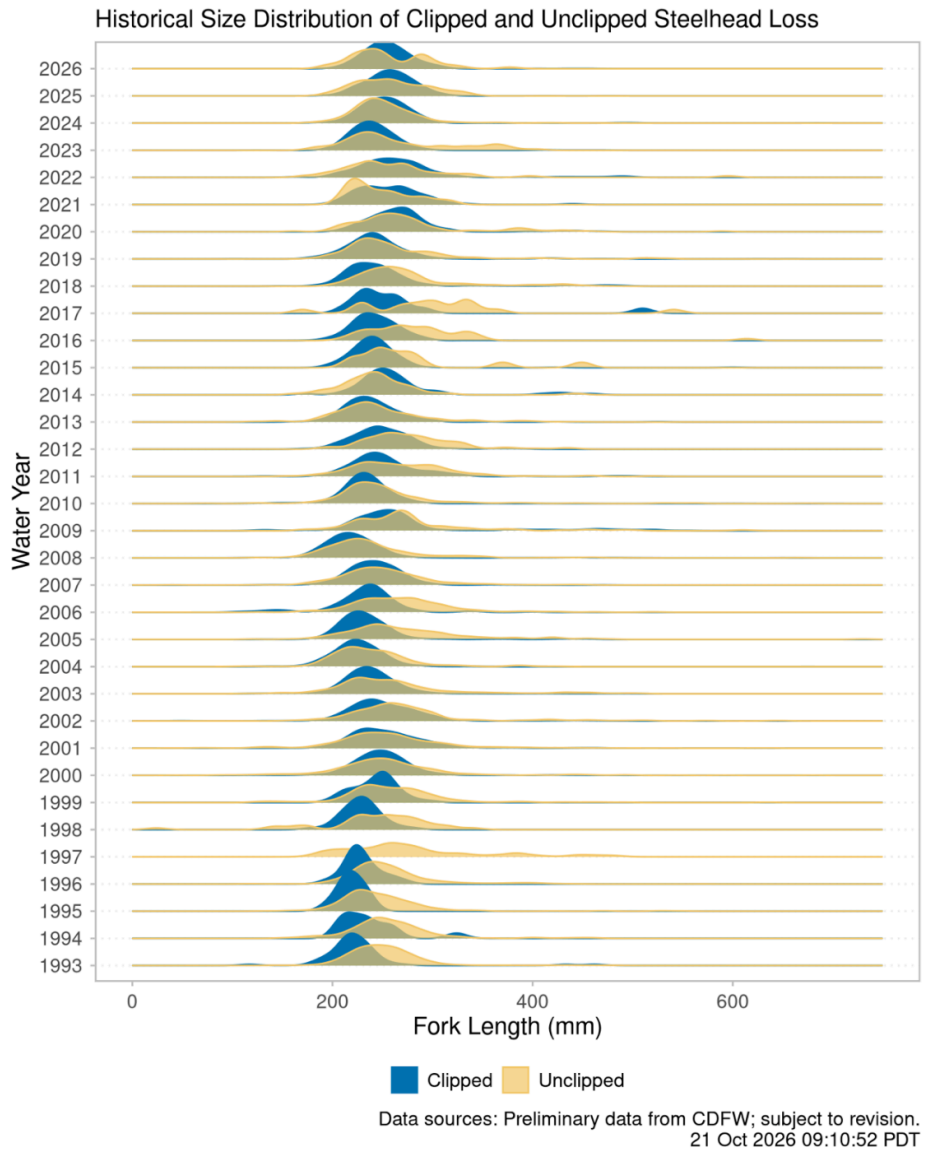
GitHub Repo | Related Query

## WY Size (Fork Length) Distribution of Steelhead Loss

## WY Size (Fork Length) Distribution of Steelhead Loss

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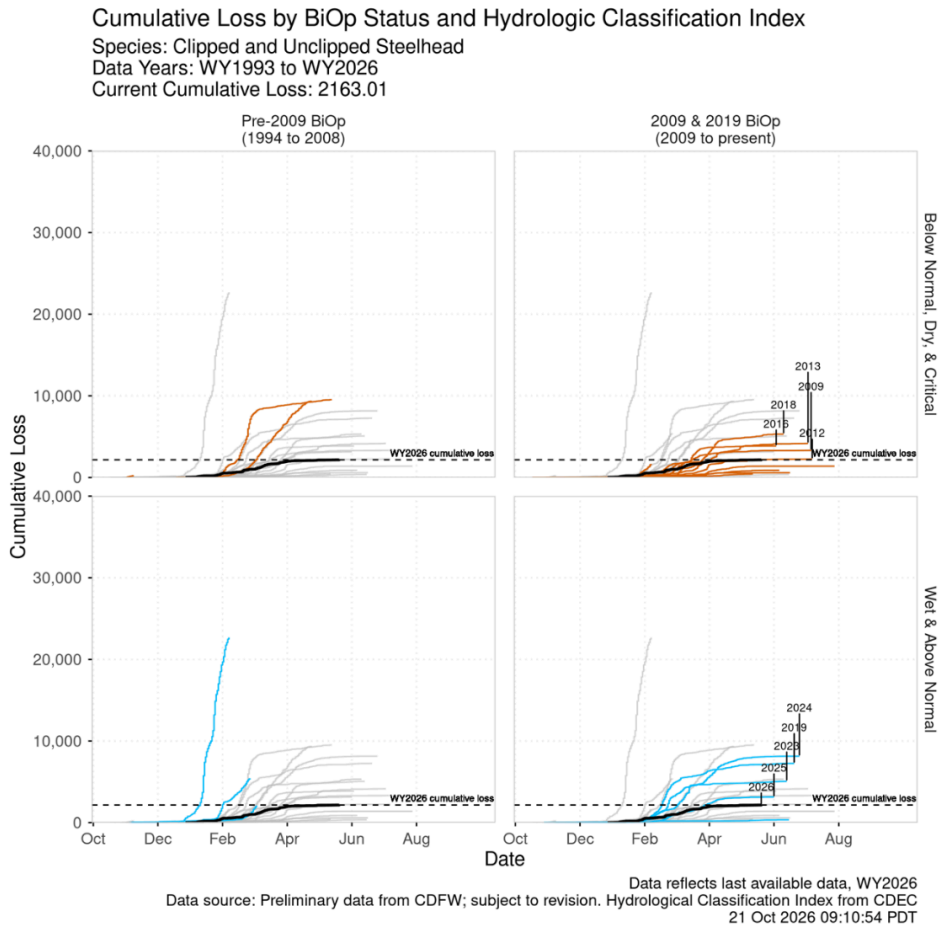



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## Cumulative Loss by BiOp Status and Hydrologic Classification Index



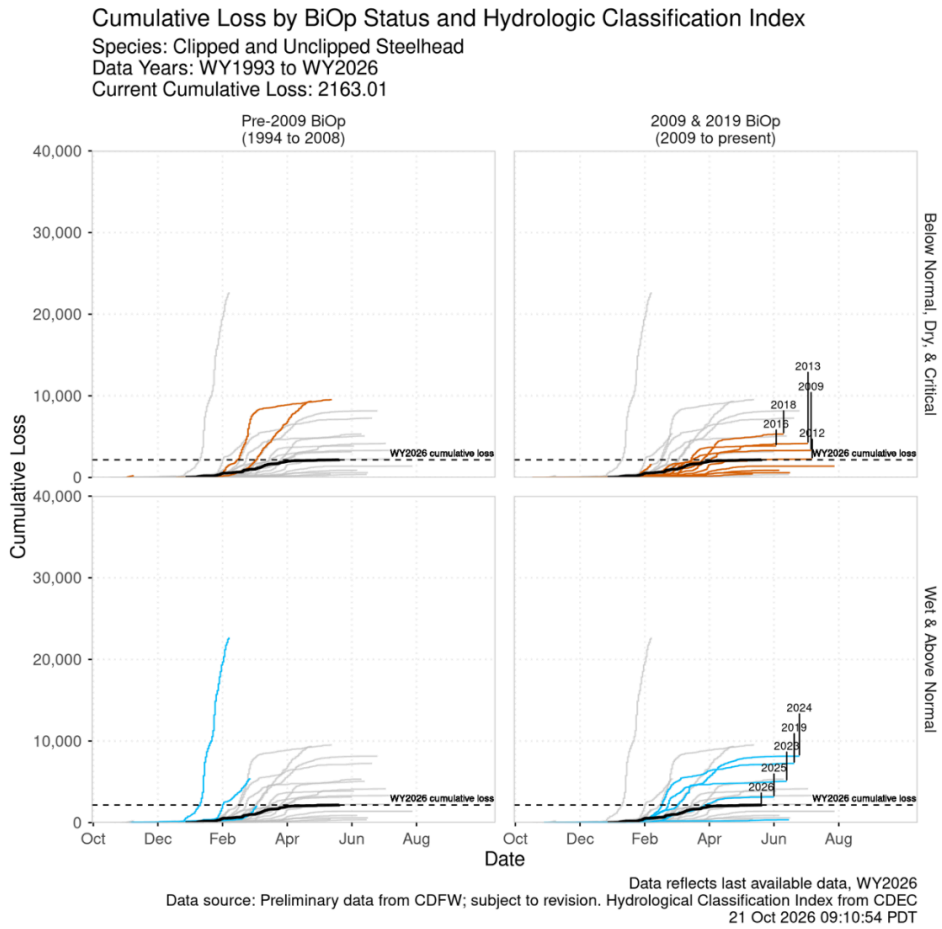

**The figure shows cumulative loss by BiOp Status and Hydrological Classification Index (HCI). Each quadrant of the faceted plot includes grey lines for historical years, colored lines (blue for wet years, red for dry years) for years within the BiOp status and HCI type, a black line for the current year, and a dashed horizontal line indicating the current cumulative loss maximum.**

GitHub Repo

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## Cumulative Loss by BiOp Status and Hydrologic Classification Index




**The figure shows cumulative loss by BiOp Status and Hydrological Classification Index (HCI). Each quadrant of the faceted plot includes grey lines for historical years, colored lines (blue for wet years, red for dry years) for years within the BiOp status and HCI type, a black line for the current year, and a dashed horizontal line indicating the current cumulative loss maximum.**

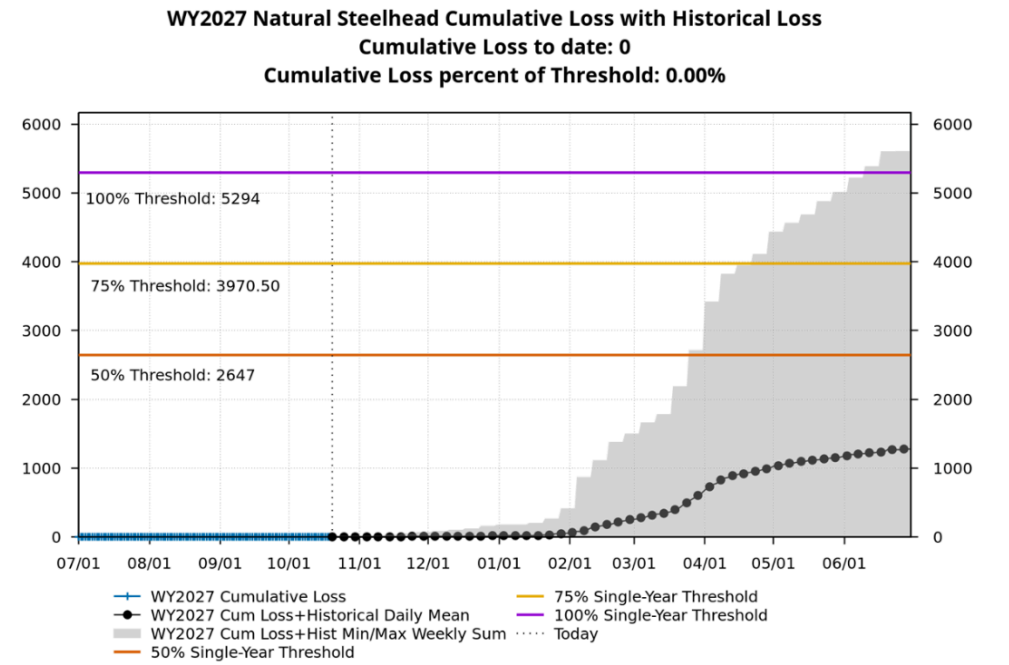
GitHub Repo

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## Loss Single Year Thresholds

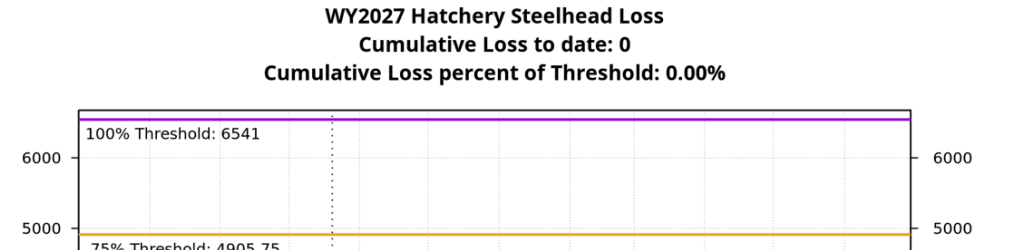
Included from Salmonids, Steelhead, and Current Conditions for the Delta Actions Team (DAT), Workgroups & Teams.




Historical Loss calculated for WY2009-2018.

www.cbr.washington.edu/sacramento/ 21 Oct 2026 07:49:03 PDT

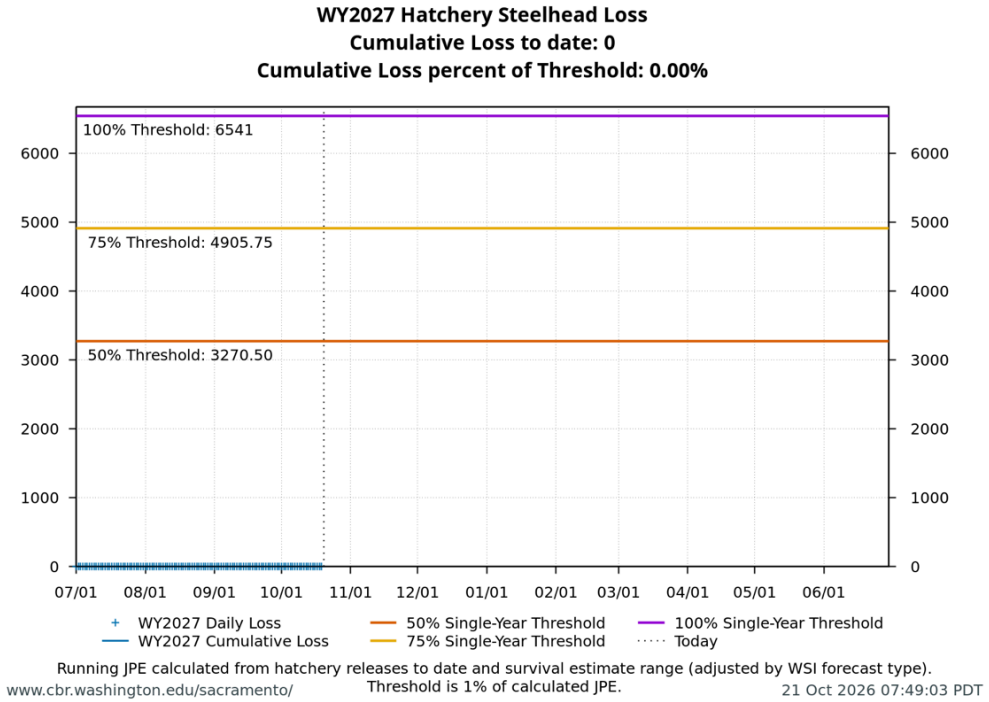
**Natural Central Valley Steelhead Loss Cumulative to Date with Historical Loss and Single Year Loss Thresholds**



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Adults in Ocean ▶
Adults in River




**Hatchery Central Valley Steelhead Loss Cumulative to Date**

## Minimization of Loss

**Annual loss of clipped juvenile steelhead at the salvage facilities and total hatchery juvenile steelhead release numbers. Coleman NFH releases from USFWS, CDFW hatchery releases available from calfish.org, salvage from Fish Salvage Monitoring, CDFW Bay Delta Region, and loss calculated by SacPAS.**

| Water Year (WY) | Brood Year (BY) | Total Hatchery Steelhead Releases (BY) | Loss of clipped steelhead at the facilities (WY) | % Loss of Total Hatchery Releases |
|---|---|---|---|---|
| **2026** | 2025 | 1398065 | 1898.37 | 0.136 |
| **2025** | 2024 | 1121944 | 2532.14 | 0.226 |
| **2024** | 2023 | 1634566 | 2850.32 | 0.174 |

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| **2025** | 2024 | 1121944 | 2532.14 | 0.226 |
| **2024** | 2023 | 1634566 | 2850.32 | 0.174 |
| **2023** | 2022 | 1649795 | 3655.74 | 0.222 |
| **2022** | 2021 | 1921199 | 639.79 | 0.033 |
| **2021** | 2020 | 1861923 | 341.69 | 0.018 |
| **2020** | 2019 | 1814005 | 659.44 | 0.036 |
| **2019** | 2018 | 1733308 | 5777.70 | 0.333 |
| **2018** | 2017 | 1175220 | 2462.90 | 0.210 |
| **2017** | 2016 | 1123732 | 164.29 | 0.015 |
| **2016** | 2015 | 1157538 | 3566.87 | 0.308 |
| **2015** | 2014 | 1989241 | 1841.19 | 0.093 |
| **2014** | 2013 | 1869840 | 327.83 | 0.018 |
| **2013** | 2012 | 1582850 | 1901.95 | 0.120 |
| **2012** | 2011 | 1782273 | 1141.16 | 0.064 |
| **2011** | 2010 | 1237276 | 2823.07 | 0.228 |
| **2010** | 2009 | 1477137 | 6548.28 | 0.443 |
| **2009** | 2008 | 1418351 | 2439.11 | 0.172 |
| **2008** | 2007 | 2085025 | 6558.86 | 0.315 |
| **2007** | 2006 | 1927957 | 4173.84 | 0.216 |
| **2006** | 2005 | 1644433 | 2758.54 | 0.168 |
| **2005** | 2004 | 1976013 | 6661.86 | 0.337 |
| **2004** | 2003 | 1413446 | 18643.98 | 1.319 |

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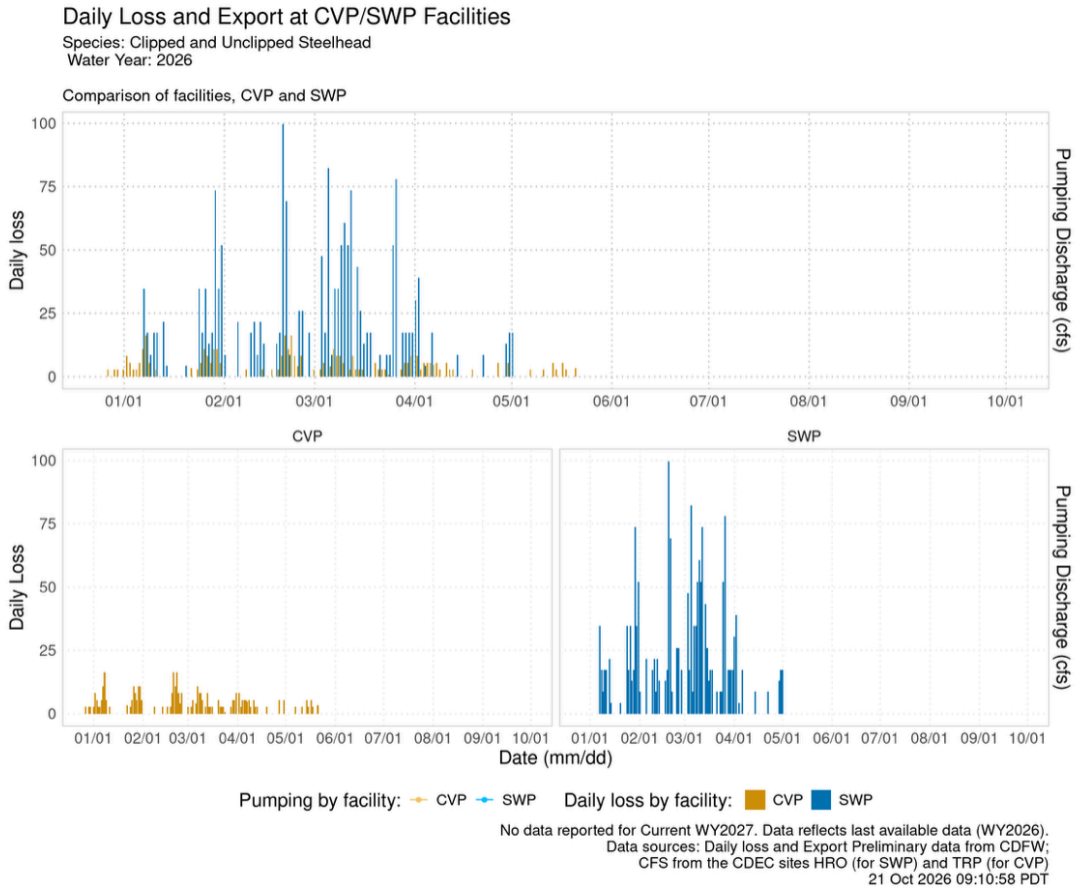
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| **2005** | 2004 | 1976013 | 6661.86 | 0.337 |
| **2004** | 2003 | 1413446 | 18643.98 | 1.319 |
| **2003** | 2002 | 1720653 | 24077.48 | 1.399 |
| **2002** | 2001 | 1093881 | 5957.45 | 0.545 |
| **2001** | 2000 | 1152854 | 24779.83 | 2.149 |
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| **1998** | 1997 | 954247 | 496.44 | 0.052 |
| **1997** | 1996 | 117434 | 4.33 | 0.004 |
| **1996** | 1995 | 930462 | 330.74 | 0.036 |
| **1995** | 1994 | 1276130 | 146.72 | 0.011 |
| **1994** | 1993 | 1327884 | 125.25 | 0.009 |
| **1993** | 1992 | 1416943 | 1576.95 | 0.111 |

Download CSV | Related Query

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## Daily Loss and Export with OMR



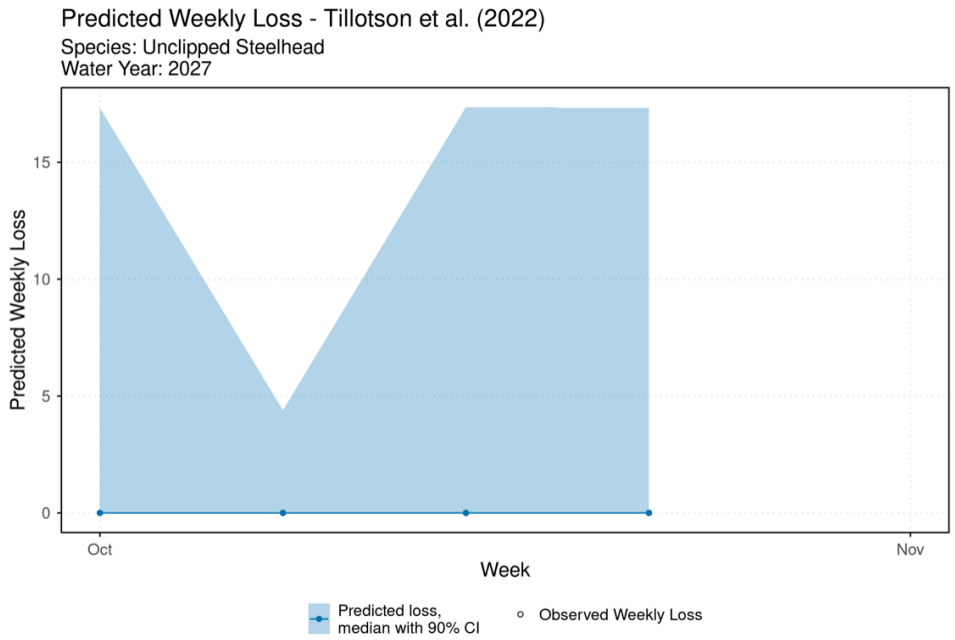

GitHub Repo | Interactive Plot

## Predicted Weekly Loss

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## Predicted Weekly Loss




**Predicted and Observed Weekly Loss — Tillotson Model**

The model is rerun with the addition of near-real-time data for new predictions as the season progresses. With each model run, the values for the historical estimates and confidence intervals are not identical due to randomization in the `randomForest` R function, but are statistically equivalent.

**Table of Tillotson et al., (2022) model output of predicted weekly losses for Natural-origin Steelhead with model weekly average inputs including observed loss, Old and Middle Rivers (OMR), USGS tidally filtered flow (CFS), combined exports from CVP and SWP facilities (CFS), flow at Sacramento and San Joaquin (CFS), and water temperature at Mallard Island (°C).**

| | | | Observed Data | | | | | |
|---|---|---|---|---|---|---|---|---|
| WY week | Date | Median weekly predicted loss [lower CI, upper CI] | Observed loss | OMR USGS tidally filtered (CFS) | Export, SWP & CVP (CFS) | Avg flow at Sacramento (CFS) | Avg flow at San Joaquin (CFS) | Avg water temperature at Mallard Island (°C) |
| 4 | 2026- | 0.0 [0.0, 17.3] | 0.0 | -1300.0 | 2082.0 | 5916.7 | 1036.1 | 18.0 |

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| | | | Observed Data | | | | | |
|---|---|---|---|---|---|---|---|---|
| WY week | Date | Median weekly predicted loss [lower CI, upper CI] | Observed loss | OMR USGS tidally filtered (CFS) | Export, SWP & CVP (CFS) | Avg flow at Sacramento (CFS) | Avg flow at San Joaquin (CFS) | Avg water temperature at Mallard Island (°C) |
| 4 | 2026-10-22 | 0.0 [0.0, 17.3] | 0.0 | -1300.0 | 2082.0 | 5916.7 | 1036.1 | 18.0 |
| 3 | 2026-10-15 | 0.0 [0.0, 17.4] | 0.0 | -4025.7 | 3441.9 | 9098.8 | 1722.5 | 18.9 |
| 2 | 2026-10-08 | 0.0 [0.0, 4.4] | 0.0 | -6567.1 | 5695.7 | 11201.5 | 1132.8 | 19.9 |
| 1 | 2026-10-01 | 0.0 [0.0, 17.3] | 0.0 | -9860.0 | 9938.4 | 15102.9 | 1006.5 | 20.4 |

GitHub Repo | GitHub Repo: Tillotson model | GitHub Repo: Data and prediction | SacPAS Tool

## Adults in Ocean

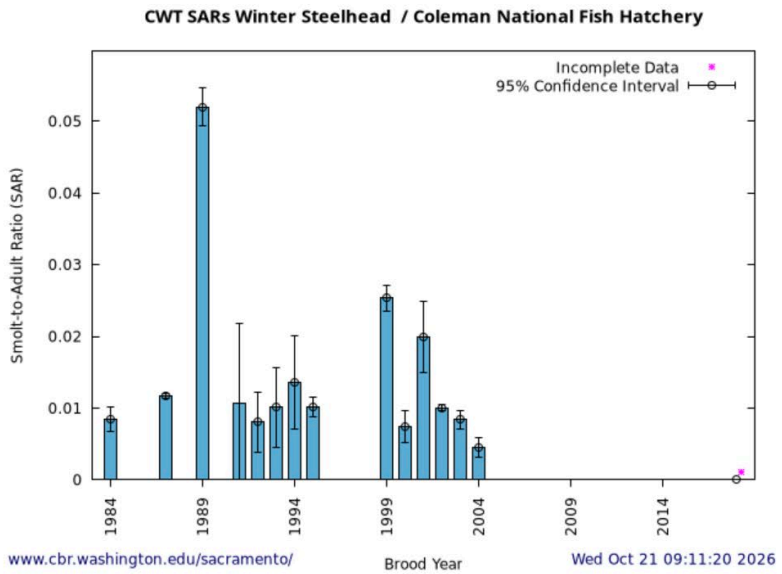
### CWT Smolt-to-Adult — annual data

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## Adults in Ocean

### CWT Smolt-to-Adult — annual data




Related Query

## Adults in River

No data sets or products to offer at this time.