



— BUREAU OF —
RECLAMATION

Water Year 2024 Seasonal Report for Old and Middle River Flow
Management

Appendix J - Steelhead Science Plan Projects



Photo credit: John Hannon

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Background

As part of the 2020 Record of Decision on the long-term operations of the Central Valley Project (CVP) and State Water Project (SWP), Bureau of Reclamation (Reclamation) has been implementing the San Joaquin Basin Steelhead Telemetry Study, Steelhead Lifecycle Monitoring Program, and San Joaquin Basin Steelhead Collaborative. The Steelhead telemetry study has been implemented annually, and with completed annual reports through 2023. The San Joaquin Basin Steelhead Collaborative started with a Delta Stewardship Council workshop in spring of 2021, which guided the interagency development and drafting of a Steelhead Science Plan. The Steelhead Science Plan was completed in summer of 2024 and is pending online posting of the document. The authors and title of the Steelhead Science Plan is as follows:

Beakes, M. P., Bilski, R., Brown, H., Collins, A., Ehlo, C., Ferguson, E., Ferguson, J., Goertler, P. A.L., Green, E., Gutierrez, M., Israel, J., Jensen, A., Kurth, R., Mahardja, B., Matthias, B., Nelson, J., Pien, C., Spear, K., and Vick, P. 2024. A Framework for Evaluating *O. mykiss* Juvenile Production and Factors Affecting Anadromy (85 pp.).

The Steelhead Lifecycle Monitoring Program has been guided by the Steelhead Science Plan, and Reclamation has been continuing monitoring programs and acquiring new studies across the Central Valley tributaries and the San Francisco Estuary to continue the development of a California Central Valley (CCV) steelhead juvenile production estimate (JPE). The CCV Steelhead juvenile production estimate (JPE) is an annual forecast of the number of outmigrating natural-origin CCV Steelhead that enter the Sacramento-San Joaquin Delta (Delta) each year. A CCV Steelhead JPE for the San Joaquin and Sacramento River basins can be used to evaluate loss at the CVP and SWP water export facilities under the context of the population. This document highlights studies and monitoring programs that are relevant to *O. mykiss* and can accelerate the development of a CCV Steelhead JPE. Note that for all studies and monitoring programs listed below, the principal investigators have accepted the responsibility for releasing data and publishing reports in open repositories and websites.

Table 1. Ongoing studies occurring as part of Steelhead Science Plan and relationship to the Juvenile Production Estimate

Study	Agency/Investigator	Relationship to JPE
American River steelhead spawning surveys	Cramer Fish Sciences	Adult steelhead counts on American River
Delta Steelhead Genetic Assessment	NMFS Southwest Fisheries Science Center	Investigating characterization of basin-of-origin/source of steelhead captured at the CVP/SWP fish collection facilities
Red Bluff Diversion Dam Rotary Trap Juvenile production indices	U.S. Fish and Wildlife Service	Provide passage estimates of several salmonid runs including steelhead.
Adult and Juvenile Salmonid Production Monitoring in Battle and Clear Creeks	U.S. Fish and Wildlife Service	Provide passage estimates of several salmonid runs including steelhead.
Sacramento River basin salmonid Monitoring	Pacific States Marine Fisheries Commission and California Department of Fish and Wildlife	Adult steelhead counts and length-at-age estimation on Antelope, Battle, Bear, Clear, Cottonwood, Cow, Deer, and Mill Creeks
Sacramento River Steelhead Telemetry Study (in acquisition phase for WY2025)	U.S. Fish and Wildlife Service	Provide transition rates and Delta survival for steelhead smolts
Estimation of Oncorhynchus mykiss demographic rates in the San Joaquin Basin with Applications to Decision-Making	U.S. Geological Survey	Developing a steelhead decision support model through the Science Integration Team.
Steelhead survival and migration submodels to support life cycle modeling	University of Washington	Implement existing steelhead migration survival models in interactive online tool and develop and implement new migration survival model for Central Valley steelhead

Study	Agency/Investigator	Relationship to JPE
American River steelhead spawning surveys	Cramer Fish Sciences	Adult steelhead counts on American River
San Joaquin River steelhead telemetry study	US Fish and Wildlife Service and UC Santa Cruz	Provide transition rates and Delta survival for steelhead smolt
Survival, travel time, and routing simulation (STARS) for steelhead in the South Delta	U.S. Geological Survey	Developing a predictive tool for transition rates and migration characteristics for San Joaquin River and Bay-Delta steelhead
Stanislaus River adult steelhead lifecycle monitoring	FISHBIO	Provide transition rates and rates of anadromy for smolt and resident steelhead
Stanislaus River steelhead redd surveys	California Department of Fish and Wildlife	Adult steelhead counts on Stanislaus River
Stanislaus River juvenile steelhead lifecycle monitoring	Cramer Fish Sciences	Provide transition rates and rates of anadromy for smolt and resident steelhead
Delta Steelhead Monitoring	U.S. Fish and Wildlife Service/California Department of Fish and Wildlife	Regularly scheduled trawl and seining efforts to aid in informing real-time operations
Survival, travel time, and routing simulation (STARS) for steelhead in the Sacramento River	U.S. Geological Survey	Developing a predictive tool for transition rates and migration characteristics for Sacramento River steelhead
Central Valley O. mykiss otolith growth and age, and natal origin reconstruction	UC Davis	Provide age structure, growth rates, and residency rates for steelhead from across Central Valley tributaries

Project Title: American River Steelhead Spawning Surveys

Principal Investigator: Cramer Fish Sciences - Jamie Sweeney

Project Collaborator (USBR): John Hannon/CCAO

Cooperating Agencies: Water Forum, California Department of Fish and Wildlife

Where has work been completed in WY 2024?

Annual spawning surveys and juvenile stranding surveys conducted January through April.

Annual Report completed:

Sweeney, J., M.Ogaz, and K.Sellheim. 2024. 2024 Steelhead (*Oncorhynchus mykiss*) spawning and stranding surveys Central Valley Project, American River, California, California Great Basin Region. 56 p.

What work has been completed in WY 2024?

The project began in 2001 with development of a spawning survey protocol and the surveys have occurred most years since then.

Project also includes salmonid stranding surveys summarized in the same report to meet a NMFS 2019 Biological Opinion term.

How was data collected and where is it being posted?

Field surveys conducted every other week, January through April, from Nimbus to Paradise Beach area by boat. Annual shapefiles and annual reports available and not posted anywhere. Reports go to Reclamation and NMFS.

How is it related to estimating the Steelhead JPE?

Most of the in-river spawners are of hatchery origin and originally came from Eel River stock. Managing for this stock in the American River reduces the chance of recovering Central Valley steelhead. The in-river spawners and offspring are listed and could contribute to any steelhead JPE efforts employed on the American River.

What are the next steps?

Continue annual spawning surveys.

Ensure PI posts shapefiles and data files.

Project Title: Delta Steelhead Genetic Assessment

Principal Investigator: NOAA Fisheries Southwest Fisheries Science Center (Devon Pearse)

Project Collaborator (USBR): John Hannon

Cooperating Organization: California Department of Water Resources, California Department of Fish and Wildlife

Where has work been completed in WY 2024?

Delta Fish Facility steelhead salvage genetic samples collected and past samples are on hand at NOAA for analysis

What work has been completed in WY 2024?

NOAA laboratory received 2023 spawned broodstock samples for MKH (n=250) FRH (n=623) NIM (n=655) CNFH (n=505) and 2024 CVP/SWP salvage CVP (N=552) and SWP (N=656) from CDFW Central Valley Tissue Archive.

Working on existing (2014-2019; N=~2,450) samples to measure straying already archived with NOAA laboratory.

Prioritizing analyzing 2023 and 2024 samples.

How was data collected and where is it being posted?

Tissue clips collected from each steelhead salvaged by the salvage operators. Samples go to CDFW tissue archive, then NOAA Fisheries investigator request these for analysis.

How is it related to estimating the Steelhead JPE?

The Delta Steelhead Genetic Assessment project aims to identify the basin of origin (Sacramento or San Joaquin) and hatchery status of steelhead. This genetic information, when combined with the JPE, helps determine the proportion of take from each basin. Understanding these proportions can reveal scenarios where overall losses are below thresholds but disproportionately effect one basin, such as the San Joaquin.

What are the next steps?

Tasks in agreement:

- 1) Assess and improve microhaplotype population genetic baseline.
- 2) Genotyping: archived samples of steelhead collected at CVP and SWP facilities.
- 3) Genotyping: samples collected at CVP and SWP facilities in water years 2024-2026.
- 4) Data Management and Analysis: Evaluate distribution of genetic variation and assess potential for genetic stock identification and adaptive genetic variation to inform the steelhead JPE framework. Curate data and make it publicly available.

5) Project Management and Reporting: Annual reports and Final Report describing the results and potential for future genetic analysis of Central Valley steelhead to inform the JPE model.

Project Title: Upper Sacramento River Red Bluff Diversion Dam Rotary Screw Trap Steelhead Juvenile Production Indices

Principal Investigator: USFWS Red Bluff (Bill Poytress)

Project Collaborator (USBR): John Hannon, Karissa Bridges, Alex Vaisvil

Where has work been completed in WY 2024? Red Bluff Diversion Dam Rotary Screw Traps

What work has been completed in WY 2024?

Annual steelhead juvenile production monitoring continued on the upper Sacramento River at Red Bluff Diversion Dam, two sites in Clear Creek, and sites in Battle Creek

In 2024 data was transitioned to SacPAS: [Juvenile Monitoring & Sampling: SacPAS Central Valley Prediction and Assessment of Salmon \(washington.edu\)](https://www.washington.edu/sacpas/juvenile-monitoring-sampling)

Data from 1995 to 2024 can be found on EDI:

Poytress, W. 2024. USFWS Red Bluff Diversion Dam Rotary Screw Trap Juvenile Fish Monitoring Database ver 11. Environmental Data Initiative. [Data Portal - Data Package Summary | Environmental Data Initiative \(EDI\) \(edirepository.org\)](https://www.edirepository.org/data-portal/data-package-summary)

RBFOW working with UW to automate the biweekly reports onto SacPAS

Reports from 2016 to 2021 and further project information can be found on their website: [Red Bluff Diversion Dam Juvenile Fish Monitoring | U.S. Fish & Wildlife Service \(fws.gov\)](https://www.fws.gov/red-bluff-diversion-dam-juvenile-fish-monitoring)

How was data collected and where is it being posted?

Fish are collected in Rotary Screw Traps at the Red Bluff Diversion Dam every 24 hours and species identified, measured, life sage assigned (fry, smolt, etc.). Steelhead juveniles between 80-200-mm fork length are weighed all others are measured and counted. Trap effort and efficiency are calculated, and daily passage and an annual juvenile production index are estimated, and data are now posted on SacPAS: Juvenile Monitoring & Sampling: SacPAS Central Valley Prediction and Assessment of Salmon (washington.edu)

How is it related to estimating the Steelhead JPE?

Knowing how many juvenile steelhead are passing the Red Bluff Diversion dam is a major piece of the puzzle for ultimately creating a JPE. Once we better understand the proportion of anadromy and the variables that may impact or trigger steelhead migration/ timing we can use the counts and annual indices to predict brood year estimates, and captured fish can be used for other studies (i.e. telemetry).

What are the next steps?

The agreement ends May 31, 2025.

2022-2024 annual reports need to be completed and uploaded.

Finalize posting biweekly reports to SacPAS.

Working with the SIT steelhead workteam, pose the following questions regarding juvenile production of steelhead captured at the screw traps:

Can these juvenile production data help determine the effects of spawning and rearing habitat restoration activities for steelhead in the Upper Sacramento River?

What are the trends in upper Sacramento River, Clear Creek, and Battle Creek steelhead juvenile production and is it supporting the CVPIA doubling goal for steelhead?

Are there environmental or operations changes influencing passage trends for juvenile steelhead in the upper Sacramento River, Clear Creek, and Battle Creek that may inform demographic differences between anadromous and resident forms of *O. mykiss*?

Project Title: Juvenile Salmonid Production Monitoring in Battle and Clear Creeks

Principal Investigator: USFWS Red Bluff (Mike Schraml, Natasha Wingerter, RJ Bottaro)

Project Collaborator (USBR): John Hannon, Karissa Bridges, Derek Rupert

Where has work been completed in WY 2024? Battle and Clear Creeks

What work has been completed in WY 2024?

- Annual steelhead juvenile production monitoring continued on two upper Sacramento River tributaries: Clear Creek (2 RSTs), and Battle Creek (1 RST)
- *Emergency Action for spring-run broodstock collection on both creeks (CDFW, UCD)

- Reports for 2022 on both creeks are complete and in review. Finalized reports will be shared 9/30/2024-- (Reports for 2023 will be completed 10/30)
- RST data up to 9/30/2023 and mark-recapture data through 8/30/2024 was compiled and sent to Ashley Vizek at FlowWest and Alin Barnes for data transfer to EDI. Unknown timeline for posting to EDI

How was data collected and where is it being posted?

Fish are collected in Rotary Screw Traps every 24 hours and species identified, measured, life stage assigned (fry, smolt, etc.). Steelhead juveniles between 50-200-mm fork length are weighed all others are measured and counted. Trap effort and efficiency are calculated, and daily passage and an annual juvenile production index are estimated.

Clear Creek monitoring occurs annually from November through June or July (When the creek reaches 74 °F)

Battle Creek monitoring continues year-round (trap pulled at temps over 74°F)

Data: 1995 to 2023/24 is in the process of being transitioned to EDI (see notes above- currently in GitHub: [GitHub - FlowWest/edi-battle-clear-rst: Repository for developing a workflow to get battle and clear RST data on EDI](#))

Final reports: 2020 and 2021 for both creeks have been added to the contract reporting folder:

I:\CONTRACTS\FY 20\R20PG00061 Red Bluff Rotary Screw Trap FWS (06.01.20-05.31.25)
John H\REPORTS

How is it related to estimating the Steelhead JPE?

Knowing how many juvenile steelhead are outmigrating from the tributaries can provide insight into migration cues, timing, and population numbers helping to ultimately create a JPE. Once we better understand the proportion of anadromy and the variables that may impact or trigger steelhead migration/ timing we can use the counts and annual indices to predict brood year estimates, and captured fish can be used for other studies (i.e. telemetry).

What are the next steps?

The agreement ends May 31, 2025.

Project Title: Battle Creek and Clear Creek Adult Steelhead Escapement Monitoring

Principal Investigator: USFWS RJ Boterro, Charlie Chamberlain

Project Collaborator (USBR): John Hannon, Karissa Bridges, Alex Vaisvil

Cooperating Organization: PSMFC operates counting weirs not focusing on steelhead here

Where has work been completed in WY 2024?

Battle Creek and Clear Creek

What work has been completed in WY 2024?

Steelhead escapement monitored in Clear Creek through redd surveys and in Battle Creek by hatchery weir.

How was data collected and where is it being posted?

Kayak redd surveys and weirs; annual reports posted by USFWS

How is it related to estimating the Steelhead JPE?

Clear Creek O. mykiss populations may be a contributor to juvenile steelhead outmigration and thus the JPE.

What are the next steps?

Continue surveys for baseline status and trends

Project Title: Sacramento River Basin Salmonid Monitoring and Central Valley Steelhead Investigations

Principal Investigator: Pacific States Marine Fisheries Commission (PSMFC) (Darin Olsen) and California Department of Fish and Wildlife (Ryan Revnak)

Project Collaborator (USBR): Lisa Elliott

Cooperating Agencies: PSMFC and California Department of Fish and Wildlife

Where has work been completed in WY 2024? Sacramento River, Clear Creek, and Mill Creek

What work has been completed in WY 2024? Staff at the CDFW CV steelhead monitoring program have analyzed, assigned age and anadromous life history expression to 161 scale samples by measuring scale annuli and back calculating age.

How was data collected and where is it being posted? Scale samples are collected as part of the PSMFC/CDFW carcass surveys. Data are not yet available except by request to PSMFC (Darin Olsen) or Ryan Revnak. Count data are available from PSMFC for video monitoring stations on Clear, Cow, Bear, Cottonwood, Battle, Antelope, Mill, and Deer Creeks.

How is it related to estimating the Steelhead JPE? Adult steelhead counts and length-at-age estimation on Antelope, Battle, Bear, Clear, Cottonwood, Cow, Deer, and Mill Creeks will help understand life-stage transition rates if the JPE framework in development is implemented on Sacramento River tributaries.

What are the next steps in FY25? Additional collecting, mounting, and digitizing of scales, in particular adding coverage for Antelope, Battle, Bear, Cottonwood, Cow, and Deer Creeks. We've also encouraged them to focus efforts more on collecting and processing otoliths instead of scales.

Project Title: Sacramento River Steelhead Telemetry Study

Principal Investigator: Red Bluff Fish and Wildlife Office (Bill Poytress), Coleman NFH

Project Collaborator (USBR): Elissa Buttermore, Karissa Bridges, Chase Ehlo

Where has work been completed in WY 2024? Project scoped in agreement between Reclamation and US Fish and Wildlife Service.

What work has been completed in WY 2024? Draft Study Plan, acquisition phase for WY2025

How was data collected and where is it being posted?

Tagging data for both wild and hatchery steelhead juveniles including fish data, tagging data, battery life, and a retention study.

as part of the Central Valley Enhanced Acoustic Tagging Project collected by both autonomous and real-time receivers throughout the Sacramento River. Data will be posted on the CalFishTrack website: CalFishTrack (noaa.gov)

How is it related to estimating the Steelhead JPE?

To accurately project a steelhead JPI we need more information about the two life history strategies (Rainbow trout and steelhead). This study will help identify and quantify migratory steelhead from resident (non-listed) Rainbow trout, benefiting our ability to

protect the listed anadromous steelhead trout while supporting real time operations of the CVP. By tracking both wild and hatchery steelhead trout migration through the river and delta we can see real-time data on timing and locations to better support our operations. The study will also provide a more comprehensive understanding of the lifecycle, migration patterns, or survival of anadromous steelhead trout, in the Sacramento River.

What are the next steps in FY25?

Tags for this study will be purchased by USBR and implanted by USFWS Red Bluff in hatchery juveniles (WY2025) and wild caught (WY2026)

Receivers in the Central Valley Acoustic Array will capture timing and movement patterns of hatchery tagged fish supporting RTO

Study Objectives

- Understand steelhead anadromy rates under various environmental conditions
- Determine outmigration survival from Upper Sacramento River (RBDD) to Benicia and Delta under various environmental conditions (temperature, flow, etc.)
- Better understand outmigration timing and cues under various environmental conditions
- Compare hatchery and wild O. mykiss outmigration timing, survival, and migratory routes
- Determine entrainment rates into the interior Delta
- Support the development of a Steelhead Juvenile Production Estimate

Project Title: San Joaquin Basin Steelhead Population and Life-History Composition

Principal Investigator: Oregon State University and USGS

Project Collaborator (POC): Chase Ehlo

Project Cooperator (USBR): USBR

Where has work been completed in WY 2024?

San Joaquin River Basin

What work has been completed in WY 2024?

- A PhD candidate continues work on the project through WY2024 and published a paper titled, 'Ontogenetic niche partitioning in a facultatively anadromous salmonid: Implications for population dynamics.'
- [Diaz, L., A. Duarte, M. Beakes, and J.T. Peterson. 2024. Ontogenetic niche partitioning in a facultatively anadromous salmonid: Implications for population dynamics. Global Ecology and Conservation 49.](#)

How was data collected and where is it being posted?

This study was a meta-analysis using age-specific habitat use of *O. mykiss* from various peer-reviewed articles as well as project partners within the Central Valley studying the species. The resulting data and analysis are available from the author.

How is it related to estimating the Steelhead JPE?

Results from this project will help fill critical knowledge gaps related to *O. mykiss* population dynamics that will aid in informing a CCV steelhead JPE.

What are the next steps?

This project was extended through WY2025 and hired a Post Doctoral researcher to continue to integrate the study findings into decision-support models to aid in prioritizing *O. mykiss* research and monitoring actions to decrease uncertainty in population models while also extending the spatial scale to include the Sacramento River Basin.

Decision support models and relevant data developed from this work will be made available in CVPIA Github repositories. <https://github.com/CVPIA-OSC>

Project Title: San Joaquin Basin Steelhead Telemetry Study

Principal Investigator: U. S. Fish and Wildlife Service (Bryan Matthias), University of California Santa Cruz (Cyril Michel), Cramer Fish Sciences (Steve Zeug)

Project Collaborator (USBR): Elissa Buttermore, Catarina Pien, Chase Ehlo

Where has work been completed in WY 2024? San Joaquin River, Stanislaus River, Bay-Delta

What work has been completed in WY 2024?

Acoustic telemetry data collected.

Table 2. Real-time preliminary information posted to CalFish Track.

Release Date	Number of Fish Released	Release Location
3/20/2024 to 3/22/2024	91	Dos Reis
3/20/2024 to 3/22/2024	104	Head of Old River
3/20/2024 to 3/22/2024	140	Durham Ferry
4/17/2024 to 4/19/2024	104	Dos Reis
4/17/2024 to 4/19/2024	91	Head of Old River
4/17/2024 to 4/19/2024	140	Durham Ferry
5/8/2024 to 5/9/2024	60	Dos Reis
5/8/2024 to 5/9/2024	116	Durham Ferry
5/8/2024 to 5/9/2024	60	Head of Old River

Received WY 2021 report from USFWS *Estimation of juvenile steelhead survival and routing migrating through the Delta 2021 Six-Year Steelhead Survival Study: Statistical Methods and Results*.

How was data collected and where is it being posted?

Data collected by acoustic receivers serviced by multiple entities, posted on Calfish Track, archived on ERRDAP.

How is it related to estimating the Steelhead JPE?

Provides survival data under various environmental conditions to aid in understanding how JPE will be affected once out-migrating steelhead move through the Stanislaus River, through the lower San Joaquin River, and Delta.

What are the next steps?

Final USFWS report for WYs 2021 to 2024 anticipated to be delivered by expiration of the current agreement (March 2025).

Future San Joaquin River/Mokelumne River Fish Hatchery acoustic tagging studies to be determined. Study objectives of estimating through Delta survival and route selection have been implemented since 2011. Two studies listed here are synthesizing those results into tools for operations. CDFW has reduced availability of Mokelumne River Hatchery Steelhead since WY 23 and reduced availability during WY24 leaving some anticipated tagging incomplete.

The Salmon Technical Work Group (Salmon TWG) reviewed studies conducted prior to 2017 and described an interest in "turning the page". The Salmon TWG submitted a final report to Collaborative Adaptive Management Team (CAMT).

Reclamation plans to continue working with Pls to tag Stanislaus wild steelhead and monitoring outmigration movement and survival through the Stanislaus River and lower San Joaquin River to support the Steelhead Science Plan.

Project Title: Coordinated Acoustic Telemetry Program Modeling Support: Survival, travel time, and routing simulations (STARS) for Steelhead in the South Delta

Principal Investigator: USGS (Russ Perry)

Project Collaborator (USBR): Cat Pien, Elissa Buttermore, Alex Vaisvil

Where has work been completed in WY 2024? San Joaquin River

What work has been completed in WY 2024?

Steelhead mark-recapture model, which will be used for this task, has been accepted (NMFS-funded)

How was data collected and where is it being posted?

No data collection involved

How is it related to estimating the Steelhead JPE?

This model will be used to form the STARS modeling framework to predict daily route-specific survival, travel time, and routing of steelhead in the South Delta. This project will ideally work in tandem with a JPE to inform management decisions for real-time and long-term operations.

What are the next steps?

Timeline: September completion

Combine existing statistical models into one San Joaquin model

Train BDO staff on using STARS model (code in R)

Create real-time version on CalfishTrack (this may be done in a subsequent year)

Project Title: Steelhead survival and migration submodels to support life cycle modeling

Principal Investigator: University of Washington (Rebecca Buchanan)

Project Collaborator (USBR): Cat, Pien, Elissa Buttermore

Where has work been completed in WY 2024? Lower San Joaquin River and Delta

What work has been completed in WY 2024?

Routing model published:

Buchanan, RA. 2024 Route use of emigrating steelhead in a heavily modified river delta. North American Journal of Fisheries Management. 44:714-734.

How was data collected and where is it being posted?

Data were collected using acoustic telemetry studies. Data have been posted on ERRDAP and the survival model (Buchanan et al. 2021) and route selection model (Buchanan 2024) model are being developed as new features on SacPAS.

How is it related to estimating the Steelhead JPE?

This project will ideally work in tandem with a JPE to inform management decisions for real-time and long-term operations.

What are the next steps?

Integrate the models as user-friendly tools on the publicly-accessible SacPAS web page.

Project Title: Stanislaus River Steelhead Population and Life-History Composition

Principal Investigator: FISHBIO (Michael Hellmair)

Project Collaborator (USBR): Chase Ehlo

Where has work been completed in WY 2024?

Stanislaus River from Goodwin Dam to Orange Blossom Recreation Area.

What work has been completed in WY 2024?

- Conducted surveys to sample adult *O. mykiss* in the Stanislaus River to aid in quantifying abundance of anadromous adults returning to spawn. A seasonal report for WY2024 has been finalized and can be made available upon request.
- Operated weir from 9/6/2023 to 4/16/2024 and estimated an escapement of 31 CCV steelhead.
- Collected hard tissues from 241 *O. mykiss* ranging from 131 to 539 mm which will be used for length-at-age reconstruction and genetic analysis as well as PIT tag individuals for opportunity to estimate the population with mark-recapture methods.
- Sampling supported other studies such as collecting scales and fin clips from juvenile fish for Cramer Fish Sciences efforts.

How was data collected and where is it being posted?

Data was collected either electronically or on physical datasheets and input into standard spreadsheets and after analysis and QA/QC, data and analysis code/tools will be made available by request or via EDI where previous years data is available:

<https://portal.edirepository.org/nis/mapbrowse?packageid=edi.1183.2>

How is it related to estimating the Steelhead JPE?

This work helps inform several parameters relevant to the Steelhead JPE. Adult monitoring, Scale and tissue analysis, and PIT tag resight data will help in determining anadromous adult returns, anadromy rates, and other life stage transition rates within the Stanislaus River, all of which are important variables in the development of a JPE for the Stanislaus River.

What are the next steps?

Continue sampling as described above to understand adult *O. mykiss* demographics in the Stanislaus River to capture annual variation such as flow and water temperature.

Update data in EDI repository to include most recent data from WY2024.

Project Title: Monitoring and Reporting of Stanislaus River Steelhead Spawning

Principal Investigator: California Department of Fish and Wildlife (Steve Tsao)

Project Collaborator (USBR): Catarina Pien

Where has work been completed in WY 2024? Stanislaus River from Goodwin Dam to Jacob-Meyers Park in Riverbank

What work has been completed in WY 2024?

Conducted redd surveys to estimate the current *O. mykiss* spawner population size in the Stanislaus River. Results will be summarized in a report, similar to that from 2021.

Received 2021 spawner report:

Kok R., & Keller E., 2023. 2021 California Department of Fish and Wildlife Steelhead Redd Survey. Report of California Department of Fish and Wildlife Service to U.S. Bureau of Reclamation, Sacramento, CA.

Hired data manager

Posted 2021-2023 data on EDI

(<https://doi.org/10.6073/pasta/2605c71a36c33bb7cf41075c1ba12a35>)

How was data collected and where is it being posted?

Data were collected on physical datasheets and input into standard spreadsheets. After QA/QC the data will be made available on EDI.

How is it related to estimating the Steelhead JPE?

This project will provide data on the distribution and abundance of spawning adult steelhead in the Stanislaus River, which are critical for estimating changes in population size and life-history composition of Stanislaus River steelhead. This work helps inform the redd count parameter for the Steelhead JPE.

What are the next steps?

- New data manager to post EDI data

- 2024 data: data to be QA/QCed by end of summer and published by end of agreement (July 2025).
- Finalizing 2022, 2023, 2024 reports
 - 2022 Report: end of Summer 2024
 - 2023 report: in review; finalize beginning of 2025
 - 2024 report: by end of agreement (July 2025)

Project Title: Stanislaus River Steelhead Population and Life-History Composition

Principal Investigator: Cramer Fish Sciences (Steve Zeug)

Project Collaborator (USBR): Chase Ehlo

Where has work been completed in WY 2024? Stanislaus River from Goodwin Dam to Orange Blossom Recreation Area.

What work has been completed in WY 2024?

Conducted surveys and implemented close-kin mark recapture an estimated spawner abundances of 4496, 4322, and 14332 for 2021, 2022, and 2023 respectively.

These same surveys in conjunction with surveys by FISHBIO and USFWS also collected hard tissues such as scales and otoliths in the Stanislaus River to estimate age and growth of juvenile *O. mykiss*. Total number samples and results will not be made available until analysis is complete.

Implemented a telemetry study to estimate instream and outmigration survival and outmigration rate of *O. mykiss* in the Stanislaus River. Preliminary analysis estimated approximately 12% of fish outmigrated past Benicia Bridge from February to May.

How was data collected and where is it being posted?

Data was collected either electronically or on physical datasheets and input into standard spreadsheets and after analysis and QA/QC, data and analysis code/tools will be made available by request or via EDI Data portal where previous years data is available:

<https://portal.edirepository.org/nis/mapbrowse?packageid=edi.1030.4>

How is it related to estimating the Steelhead JPE?

This work helps inform several parameters relevant to the Steelhead JPE. Mark-recapture estimates will provide initial estimates on spawner abundance, juvenile age and growth will

help in understanding the age and size structure of the population as well as life-stage transition estimates, and telemetry work will also help in estimating life-stage transition estimates and outmigration rate.

What are the next steps?

Continue refining close-kin mark recapture estimates to provide estimates on population size and spawner abundance.

Continue juvenile sampling efforts to collect demographic data as well as scale and otolith data to further inform those demographic rates such as age, growth, and survival.

Continue integrating telemetry to estimate instream and outmigration survival and outmigration rate.

Ensure PI posts data files and annual reports.

Project Title: Delta monitoring of Steelhead populations

Principal Investigator: US Fish and Wildlife Service (Eric Huber), California Department of Fish and Wildlife (Steve Tsao)

Project Collaborator (USBR): Brian Mahardja, Alex Vaisvil

Where has work been completed in WY 2024? Sacramento River, San Joaquin River, and the Delta

What work has been completed in WY 2024?

Regularly scheduled sampling conducted by USFWS and CDFW to aid in informing real-time operations teams during the OMR management season.

Sacramento River Trawls are conducted to monitor the number of fish in the delta from the Sacramento River, Mossdale Trawls are conducted to monitor the number of fish entering the delta from the San Joaquin River, and Chipps Island Trawls are conducted to monitor the number of fish exiting the delta to the Ocean.

How was data collected and where is it being posted?

Data was collected either electronically or on physical datasheets and input into standard spreadsheets and after analysis and QA/QC, data and analysis code/tools will be made available by request, via a secure online depository (i.e. EDI Data Portal), and/or emailed to recipients on a weekly basis.

How is it related to estimating the Steelhead JPE?

While not directly associated with the JPE this sampling helps to understand the outmigration timing of Steelhead into the delta in the case of the Sacramento River and Mossdale Trawls and out of the delta into the Ocean in the case of Chipps Island Trawl. This, combined with salvage data may help to better understand the extent of fish being lost to export facilities compared to successfully out-migrating relative to the JPE.

What are the next steps?

Technical Memorandum on Mossdale Trawl will be completed describing relative abundance, passage estimates, and proportion of steelhead, spring, and fall-run Chinook in the San Joaquin River system.

Create Mossdale Trawl CalFish page

Ensure PI posts data files.

Project Title: Survival, travel time, and routing simulation (STARS) for steelhead in the Sacramento River

Principal Investigator: University of Washington (Rebecca Buchanan)

Project Collaborator (USBR): Catarina Pien, Elissa Buttermore

Where has work been completed in WY 2024?

Project scoped in agreement between Reclamation and U. of Washington.

What work has been completed in WY 2024?

No work has been completed yet.

The tasks are:

- Implement a new steelhead migration survival model for the Sacramento River Basin and North Delta using daily observed and forecasted environmental data

- Develop an interactive tool for existing steelhead survival migration models in the South Delta/San Joaquin

How was data collected and where is it being posted?

No data collection involved, but interactive tools will be posted on SacPAS.

How is it related to estimating the Steelhead JPE?

The new Sacramento River model will be used to form the modeling framework to predict daily route-specific survival, travel time, and routing of steelhead in the Sacramento River Basin and North Delta. This project is primarily aiming to inform real-time operations and LTO work. As the model has not yet been developed, output metrics can be advanced to be more informative for the JPE.

What are the next steps?

Work will begin towards the end of this water year

South Delta/San Joaquin task: Will begin to get input on which parameters are desired for interactive tool.

Sacramento River modeling task: Will begin to explore data sources, determine what is possible for model.

Project Title: Using otolith-based approaches to derive demographic parameters for California Central Valley Steelhead

Principal Investigator: University of California, Davis Otolith Geochemistry & Fish Ecology Laboratory

Project Collaborator (POC): Brian Mahardja

Project Cooperator (USBR): USBR

Where has work been completed in WY 2024?

N/A. Study will make use of archived and presumed wild *O. mykiss* (adipose present at collection) otoliths sampled between 1997 and 2022 from the American, Feather, Merced, Sacramento, Stanislaus, and Tuolumne Rivers

What work has been completed in WY 2024?

- Coordination meetings between UC Davis, USBR, and CDFW were conducted to select samples and define prioritization criteria (e.g., focus on larger fish >250 mm fork length with adipose fin intact, etc.).
- Otolith samples were collected and transferred to UC Davis laboratory
- Specialist position for the project was advertised and hired
- A number of steelhead otoliths have been prepared to determine the optimal sections and imaging methods for the study

How is it related to estimating the Steelhead JPE?

In this study, otolith-based approaches will be used to reconstruct the age, growth, and migratory behaviors of Central Valley steelhead from several tributaries of the Sacramento and San Joaquin River watersheds. This work helps inform several parameters relevant to the Steelhead JPE, such as age structure of the different *O. mykiss* populations, their growth rates, and outmigration rates. Data on age, growth, and migration will also be combined to quantify differences among watersheds and how these vary in response to hydroclimatic conditions and water management actions.

What are the next steps?

- Continue with the optimization of the sample processing protocol, collect the rest of the archived samples, and analyze all the otolith samples