Annual Report to the National Marine Fisheries Service for Fisheries Restoration Grant Program Projects Authorized under the Department of the Army Regional General Permit No. 12

For the period of January 1, 2023, through December 31, 2023

Prepared by the Pacific States Marine Fisheries Commission for the California Department of Fish and Wildlife

March 1, 2024

Cover photo Gulch C Coho Salmon Fish Passage Improvement Project on Gulch C, tributary to Noyo River, Mendocino County, California.

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Introduction

The San Francisco District of the U.S. Army Corps of Engineers (USACE) re-issued Regional General Permit No. 12 (RGP-12) to the California Department of Fish and Wildlife (CDFW) on May 8, 2023. Pursuant to section 404 of the Clean Water Act, RGP-12 authorizes an array of instream, riparian, and upslope habitat improvement activities. This authorization is within the U.S. Army Corps of Engineers, San Francisco District (Figure 1). The authorization applies to salmonid habitat restoration projects specifically funded under the Fisheries Restoration Grant Program (FRGP).

Special Condition #1 of RGP-12 is to implement Terms and Conditions as stipulated in the National Marine Fisheries Service (NMFS) biological opinion (BO). The BO was issued on May 18, 2022, and is Consultation Number WCRO-2021-03365. The BO Section 1.1.1.3 Project Tracking and Annual Reporting stipulates that CDFW submit an annual report on the previous year's restoration activities by March 1st to NMFS. This report is submitted in compliance with those Terms and Conditions, and this document summarizes data for FRGP projects administered by CDFW that utilized RGP-12.

This report includes analysis of data documenting effects of FRGP activities on listed salmonids and their critical habitat, including effects from exposure to project implementers and monitoring activities by CDFW during the calendar year. Metrics have been compiled and validated. Information is included about each restoration project or monitoring effort conducted during the reporting period. Summaries compare actual activity exposure and mortality data to the maximum activity exposure and mortality anticipated for each species.

A narrative description of any requested variances from the limitations as described in the BO Proposed Action section and their resolution is included.

This report also summarizes implementation assessments provided by CDFW grant managers for restoration projects with activity during 2023. Effectiveness, validation, and Before After Control Impact (BACI) assessments conducted by the Pacific States Marine Fisheries Commission's (PSMFC) Monitoring and Evaluation of Salmonid Habitat Restoration (MESHR) program are also summarized. It also includes a narrative description of how any project-specific information collected during the previous year (such as effectiveness monitoring) was or should be used to assess the effects and benefits of salmonid restoration projects authorized through FRGP.

Questions regarding this report should be directed to Mr. Timothy Chorey at (916) 838-0760 or via email at Timothy.Chorey@wildlife.ca.gov.

Figure 1. USACE Districts. Report activities occurred in the U.S. Army Corps of Engineers, San Francisco District.

Effects of Program Activities on Juvenile Listed Salmonids and their Critical Habitat

Fish Relocation Activities

Restoration construction can require fish exclusion from the project site to minimize harm and mortality to salmonids and other aquatic species. In 2023, only three restoration projects required fish relocation because many stream channels were dry. Project-specific relocation details are presented in the attached file *Appendix_1_Relocation_RGP12_2023.xlsx*. Fish relocation activities are reported for the following Evolutionarily Significant Units (ESU) or Distinct Population Segments (DPS):

- Southern Oregon/Northern California Coastal (SONCC) coho salmon
- Central California Coastal (CCC) coho salmon
- Coastal California (CC) Chinook salmon
- Northern California (NC) steelhead
- CCC steelhead
- South-Central California Coast (S-CCC) steelhead.

The BO (Section 2.8.4) states that injury or mortality from fish relocation is anticipated to be no more than three percent of the affected listed species for each project. A summary of reported juvenile salmonids by ESU/DPS captured and relocated prior to dewatering for project implementation compared to estimates of handling and three percent mortality are presented in Table 1.

Table 1. Annual exposure estimates and anticipated injury and mortality response of juvenile salmonid species resulting from capture and relocation prior to dewatering, as well as crushing and desiccation, compared to reported.

	SONCC coho salmon	CCC coho salmon	CC Chinook salmon	NC steelhead	CCC steelhead	S-CCC steelhead
Maximum Number of Juveniles	1,650	425	30	8,850	1,575	1,575
Reported Number of Juveniles	3	0	0	5,298	503	0
3% Mortality	50	13	1	226	47	47
Reported Number of Mortalities	0	0	0	46	7	0
Reported Mortality	0	0	0	0.88%	1.4%	0

Monitoring Activities

Limits for handling, capturing, and tagging juvenile salmonids, as well as mortality limits, during monitoring activities and reported numbers of juveniles observed are summarized in Table 2 along with reported results. No juvenile salmonids were handled, captured, or tagged, and there were no injuries or mortality from monitoring activities.

Table 2. Annual exposure estimates of juvenile salmonids captured, handled, and tagged during project monitoring, and anticipated injury mortality response compared to reported numbers.

ESU/DPS	Maximum Number of Juveniles Captured and Handled	Reported Numbers of Juveniles Observed	Maximum Number of Juveniles PIT tagged	Anticipated injury and mortality (3%)
SONCC coho salmon	2500	**8**	25	75
CCC coho salmon	500	**480**	50	15
CC Chinook salmon	30	**0**	10	1
NC steelhead	9000	**91**	900	270
CCC steelhead	1000	**141**	100	30
S-CCC steelhead	1000	**156**	100	30
Unknown Salmonid	NA	**1**	NA	NA

Project Locations

Project locations ranged from the California-Oregon border south to Monterey County, and as far east as Siskiyou County. A project list organized by United States Geological Survey (USGS) Fourth Field Hydrologic Unit Code (HUC) 8 and Fifth Field HUC 10 are found in *Appendix_2_HUC_RGP12_2023.xlsx* in the attached files. The locations of the 11 projects on the 2023 RGP-12 Project Notification List with work done in 2023 are presented in Figure 2. Individual project detail stratified by primary benefitted species ESU for salmon and DPS for steelhead is provided in attached file *Appendix_3_ESU_DPS_RGP12_2023.xlsx*.

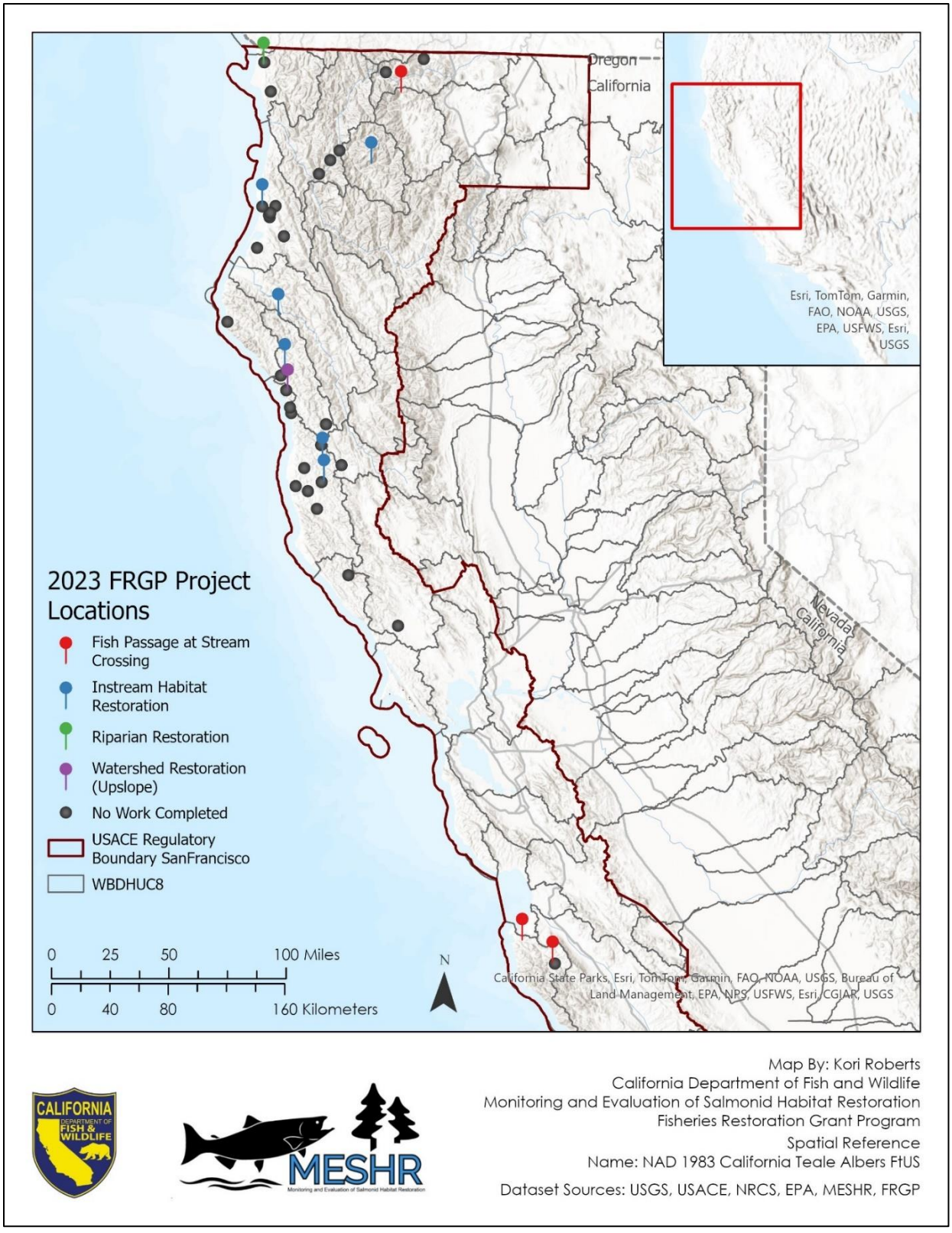

Figure 2. Project coordinates from the 2023 RGP-12 Notification List for the Fisheries Restoration Grants Program with work completed in 2023.

Annual Performance Measures

Restoration on any project consists of one or more distinct features. Features are defined as a physical element intended to interact with the environment to improve anadromous salmonid habitat. Project-specific performance measures of restoration features constructed during 2023 are found in the attached file *Appendix_4_Annual_Implementation_Measures_RGP12_2023.xlsx*.

Annual performance measures of restoration features implemented during 2023 are summarized in annual reports written by grantees and confirmed in the field by CDFW grant managers (Table 3).

Table 3. Annual performance measures of projects with features implemented in 2023.

2023 Annual Performance Measures		Total
Number of instream structures implemented within the stream channel.		253
Type of instream structures implemented within the stream channel.	Log, rootwad, boulder instream habitat restoration combinations | Boulder structures (other) | Log/rootwad structures (other) | Instream improvement (other) | Boulder/log combo constrictor - opposing | Single log structure (digger/cover log) | Multiple log structure (spider logs/cover log complex) | Cover root wads | Cover logs (horizontal) | Unanchored large wood	
Length of stream bank (feet) stabilized or planted with riparian species.		5,772
Number of culverts replaced or repaired.		3
The number of miles of restored access to unoccupied salmonid habitat (from culverts replaced or repaired).		2.31
Distance (miles) of road decommissioned.		3.7
Distance (feet) of aquatic habitat disturbed at each project site.		6,876
Length of bioengineered streambank (feet) restored.		0
Active channel width at bioengineered streambank (feet) restored.		0
Size (acres) of off channel habitat features enhanced or created.		6.48

2023 Annual Performance Measures	Total
Size (length) of off channel habitat features enhanced or created.	4,205
Size (depth) of off channel habitat features enhanced or created.	117
Size of dams removed (cubic yards).	0
Number of dams removed.	0
Number of miles of restored access to unoccupied salmonid habitat (from dam removal).	0

A summary of off channel habitat enhancement metrics from project Q2010510 are listed by individual feature in Table 4.

Table 4. Size (acres, length, and depth) of off-channel habitat enhanced or created by individual features from Project Q2010510: Bull Creek Hamilton Reach Instream and Floodplain Habitat Restoration Project.

Acres	Length (Feet)	Depth (Feet)
1.01	659	14
0.39	132	10
0.29	155	10
0.11	308	11
0.04	111	10
0.067	207	10
0.054	123	10
0.15	241	10
0.013	10	10
3.6	1529	12
0.009	10	10

How Project-specific Information Collected was Used to Assess the Effects and Benefits of Salmonid Restoration Projects

Implementation Monitoring

Methods

The BO (Section 2.8.4) requires that CDFW provide NMFS with a list of projects authorized under RGP-12 to be conducted each year (Notification List). Work status definitions for the Notification List and Appendix 2 are provided in Table 5.

Table 5. Work status definitions.

Status	Description
Not started	Proposal selected for funding but grant not written yet, or grant written but on-the-ground work has not started.
Ongoing	From the beginning to the end of on-the-ground work.
Completed	From the end of on-the-ground work until the grant is closed.

Work status of restoration projects included on the RGP-12 2023 Notification List are in Table 6.

Table 6. Work status of restoration projects included on the RGP-12 2023 Notification List.

Project Type	Not Started	Ongoing	Completed	Total
Fish Passage at Stream Crossings	0	6	1	7
Instream Habitat Restoration	2	16	7	25
Instream Barrier Modification for Fish Passage	0	0	1	1
Watershed Restoration (Upslope)	0	0	1	1
Riparian Restoration	0	1	0	1
Instream Bank Stabilization	0	0	0	0
Fish Screening of Diversions	0	0	0	0
Water Conservation Measures	0	0	0	0
Project Design	0	4	2	6
Total	**2**	**27**	**12**	**41**

FRGP project status definitions for the Notification List and Appendix 2 are provided in Table 7.

Table 7. FRGP Project Status Definitions.

Status	Description
Field work not started	On-the-ground work has not started.
Field work in progress	From the beginning to the end of on-the-ground work.
Field work completed	From the end of on-the-ground work until the grant closeout.
Closed	Grant agreement has been closed out.

FRGP project status for restoration projects on the 2023 RGP-12 2023 Notification List are in Table 8.

Table 8. FRGP project status for restoration projects on the RGP-12 2023 Notification List.

Project Type	Field Work Not Started	Field Work in Progress	Field Work Completed	Closed	Total
Fish Passage at Stream Crossings	2	4	0	1	7
Instream Habitat Restoration	9	9	2	5	25
Instream Barrier Modification for Fish Passage	0	0	0	1	1
Watershed Restoration (Upslope)	0	0	1	0	1
Riparian Restoration	0	1	0	0	1
Project Design	0	4	0	2	6
Total	**11**	**18**	**3**	**9**	**41**

All stages of monitoring (pre-treatment, implementation, and post-treatment) evaluate feature construction and effectiveness. Implementation monitoring occurs the same year

as feature construction and is done multiple times on the same project if features are constructed over multiple years. For example, an instream habitat restoration project could include seven instream structures but only four were completed during 2023. Implementation monitoring for 2023 would only report on the four completed features and the remaining features would receive implementation monitoring during the year of construction.

Implementation monitoring by CDFW grant managers assesses installation of individual restoration features throughout construction. Completed features are rated as excellent, good, fair, poor, or fail, based on the criteria presented in Table 9.

Table 9. Implementation feature ratings criteria.

Rating	Implementation	Action
Excellent	Meets all specifications and exceeds expectations.	No action required.
Good	Meets all specifications and expectations.	No remedial action required.
Fair	Does not meet some specifications and expectations but implemented adequately.	Probably not serious enough to require remedial action.
Poor	Does not meet most specifications and expectations, implemented inadequately.	Serious enough to require remedial action.
Fail	Fails to meet specifications, implemented incorrectly, or not implemented.	Serious enough to require remedial action.

Results

Eleven projects had work done in 2023 and all received implementation monitoring by grant managers, including 278 of 337 features implemented (Table 10). Grant managers were unable to complete implementation monitoring on 100% of project features because projects were in remote locations or impacted by 2023 fires. A good or excellent rating was given to 242 (87.1%) of the features (25 excellent and 217 good). Of the remaining 36 features (12.9%) 33 were rated fair and only three were rated as poor. No features were rated as failed. Project-specific implementation monitoring information of restoration features constructed during 2023 is provided in *Appendix_5_Feature_Ratings_RGP12_2023.xlsx*.

Table 10. Feature implementation ratings assigned in 2023 by project type.

Project Type	Total Number of Project Features	Number of Features Monitored	Excellent	Good	Fair	Poor	Fail
Fish Passage at Stream Crossings	24	17	6	9	2	0	0
Instream Habitat Restoration	261	210	12	172	25	1	0
Riparian Restoration	21	21	7	14	0	0	0
Watershed Restoration (Upslope)	31	30	0	22	6	2	0
Total Feature Ratings	**337**	**278**	**25**	**217**	**33**	**3**	**0**
% Of Total	**100.0**	**82.5**	**7.4**	**64.4**	**9.8**	**0.9**	**0.0**

An implementation rating is assigned to the project based on criteria presented in Table 11. For example, a project is rated good if 80% or more of its features were rated as either good or excellent, with no more than 10% of features rated as poor and no features rated as fail. Grant managers work with grantees to remedy features rated as poor or fail. Upon remediation, the final feature rating is reported as excellent, good, or fair.

Table 11. Project rating criteria based on cumulative percentage of feature ratings.

	Excellent Feature Ratings	Good Feature Ratings	Fair Feature Ratings	Poor Feature Ratings	Fail Feature Ratings
Excellent Project Rating	≥ 80%			0%	0%
Good Project Rating	≥ 80%	≥ 80%		≤ 10%	0%
Fair Project Rating	≥ 80%	≥ 80%	≥ 80%		<10%
Poor Project Rating	≥ 50%	≥ 50%	≥ 50%		<25%
Failed Project Rating	<50%	<50%	<50%	≥ 50%	≥ 50%

Discussion

Nine of eleven projects monitored at implementation received project ratings of good, with one fish passage project rated excellent and another rated fair (Table 12).

Table 12. Project ratings for implementation monitoring in 2023.

Project Type	Projects Monitored	Excellent	Good	Fair	Poor	Fail
Fish Passage at Stream Crossings	3	1	1	1	0	0
Instream Habitat Restoration	6	0	6	0	0	0
Riparian Restoration	1	0	1	0	0	0
Watershed Restoration (Upslope)	1	0	1	0	0	0
Total Project Ratings	**11**	**1**	**9**	**1**	**0**	**0**
% Of Total	**100**	**9.1**	**81.8**	**9.1**	**0**	**0**

Effectiveness Monitoring

Methods

Effectiveness monitoring by MESHR is conducted on a stratified random selection of 10% of each project type in each USACE watershed (i.e., North Coast, North Central Coast, and San Francisco Bay) funded each year. Effectiveness monitoring has two phases: pre-treatment monitoring and post-treatment monitoring (Table 13). Pre-treatment monitoring documents baseline data on habitat conditions before on-the-ground restoration treatments begin, providing a benchmark to evaluate restoration activity effectiveness. Pre-treatment monitoring is generally conducted before construction the same year as project implementation.

Post-treatment monitoring is usually conducted three years after project completion to ensure projects experience multiple winter high-flow periods. Post-treatment monitoring may be deferred to other years, or additional monitoring may be added if appropriate and resources are available.

Table 13. Projects that received effectiveness monitoring in 2023.

Grant Number	Project Type Code	Grant Name	Monitoring Visit
Q2110505	Fish Passage at Stream Crossings	Scott Bar Mill Creek Fish Passage Improvement Project	Pre-effectiveness
Q2140408	Fish Passage at Stream Crossings	Potrero Creek Fish Passage Lower Culvert Project - Carmel Valley Athletic Club	Pre-effectiveness
Q2140409	Fish Passage at Stream Crossings	Weston-Champagne Cachagua Creek Fish Passage Project	Pre-effectiveness
Q2210506	Instream Habitat Restoration	Lower Stotenburg Coho Habitat Enhancement Project	Pre-effectiveness
Q1910507	Instream Habitat Restoration	Middle Slough Restoration Project - Phase 2	Post-effectiveness
Q1910528	Watershed Restoration (Upslope)	Julias Creek Sediment Reduction and Salmonid Recovery Project	Post-effectiveness
P1610504	Instream Habitat Restoration	James Creek Coho Stream Habitat Enhancement Project	Post-effectiveness
P1710529	Fish Passage at Stream Crossings	Little Springs Migration Barrier Removal	Post-effectiveness
P1730411	Instream Barrier Modification for Fish Passage	Fish Passage and Off-Channel Habitat Restoration at Roy's Pools	Post-effectiveness
P1810503	Fish Passage at Stream Crossings	Gulch C Coho Salmon Fish Passage Improvement Project	Post-effectiveness
Q1910513	Instream Habitat Restoration	East Branch North Fork Big River Coho Habitat Enhancement Project - Large Wood Installation	Post-effectiveness

Results

Pre-treatment monitoring was conducted on four restoration projects in 2023 (Table 14) and 44 out of 46 features were evaluated. One site with two features, one for vegetation control and removal and the other for revegetation, was not monitored because of inability to access due to overgrown blackberries.

Table 14. Number of pre-treatment projects monitored during 2023 by project type.

Project Type	Total
Fish Passage at Stream Crossings	3
Instream Habitat Restoration	1
Instream Barrier Modification for Fish Passage	0
Watershed Restoration (Upslope)	0
Total	**4**

Post-treatment effectiveness monitoring evaluates structural integrity and function of completed restoration features three years after implementation. Each feature is rated as excellent, good, fair, poor, or fail, based on the criteria presented in Table 15.

Table 15. Post-treatment effectiveness feature rating criteria.

Rating	Goals	Targets	Unintended effects	Structural condition
Excellent	Achieved all stated goals.	Met or exceeded targeted values.	No negative unintended effects. Unintended positive effects may outweigh failure to achieve a targeted value.	Excellent to Good.
Good	Achieved most stated goals.	Did not quite meet targeted values. If no targets were specified, maximum rating is Good.	No negative unintended effects.	Excellent to Fair.
Fair	Partially achieved most goals, or goals not achieved were outside the control of the feature.	Did not meet targeted values, but the feature still has some functional value.	May have minor unintended negative effects that partially offset goals.	Excellent to Fair.
Poor	Achieved at least one goal; goals not achieved were the fault of the feature.	Did not meet targeted values, feature has little functional value.	May have minor or major unintended negative effects that offsets or negates a targeted gain.	Excellent to Poor.
Fail	Achieved no goals; feature has no functional value.	Did not meet targeted values.	May have unintended negative effects that are degrading the habitat and outweigh achieved goals.	Excellent to Fail (may be completely gone).

Discussion

There were 159 project features ready for post-treatment evaluation in 2023, of which 119 (74.8%) were monitored. Forty features were not monitored at post-treatment because feature locations were difficult to access, were not monitored at pre-treatment, changed location, or could not be located. Most of these features came from the Julias Creek Sediment Reduction project where road decommissioning was done so successfully that many of the features could not be reached in a full day of hiking. The James Creek Coho Stream Habitat Enhancement Project had three features not monitored at pre-treatment and one feature that could not be located in the field. The East Branch North Fork Big River Coho Habitat Enhancement Project - Large Wood Installation project had eight features that were not monitored at pre-treatment. The Fish Passage and Off-Channel Habitat Restoration at Roy's Pools project had one feature that was surveyed at pre-treatment but did not appear to have been implemented.

At post-treatment monitoring 115 features (96.6%) received good ratings, three features (2.5%) received fair ratings, and one feature received a poor rating (0.8%). No features received excellent or fail ratings (Table 16). Feature and project ratings for completed projects monitored in 2023 are in an attached Excel file *Appendix_4_Effectiveness_RGP12_2023.xlsx*.

Table 16. Feature ratings from post-treatment effectiveness monitoring by project type.

Project Type	Excellent	Good	Fair	Poor	Fail	Total
Fish Passage at Stream Crossings	0	19	2	1	0	22
Instream Habitat Restoration	0	56	1	0	0	57
Instream Barrier Modification for Fish Passage	0	12	0	0	0	12
Watershed Restoration (Upslope)	0	28	0	0	0	28
Riparian Restoration	0	0	0	0	0	0
Instream Bank Stabilization	0	0	0	0	0	0
Fish Screening of Diversions	0	0	0	0	0	0
Water Conservation Measures	0	0	0	0	0	0
Total	**0**	**115**	**3**	**1**	**0**	**119**
% Of Total	**0**	**96.6%**	**2.5%**	**0.8%**	**0**	**100%**

An effectiveness rating for the whole project is calculated from the individual feature ratings using criteria in Table 11 above. Project proposals do not always list specific numeric targets for habitat improvements, which is required for an excellent rating. In 2023, seven projects received effectiveness project ratings, and all received good ratings (Table 17).

Table 17. Project ratings from post-treatment monitoring in 2023.

Project Type	Excellent	Good	Fair	Poor	Fail	Total
Fish Passage at Stream Crossings	0	2	0	0	0	2
Instream Habitat Restoration	0	3	0	0	0	3
Instream Barrier Modification for Fish Passage	0	1	0	0	0	1
Watershed Restoration (Upslope)	0	1	0	0	0	1
Riparian Restoration	0	0	0	0	0	0
Total	0	7	0	0	0	7
% of Total	**0**	**100%**	**0**	**0**	**0**	**100%**

Validation Monitoring

Three project types receiving effectiveness monitoring also receive validation monitoring: instream habitat improvement (HI), fish passage at stream crossings (FP), and instream barrier modification for fish passage (HB). An upslope watershed restoration (HU) project can also include validation monitoring if it has an instream component. As of 2014, a subset of HI projects with validation monitoring also received BACI monitoring to evaluate habitat metrics, fish response, and effectiveness of large wood (LW) treatments.

Methods

Validation monitoring consists of three distinct efforts: 1) juvenile snorkel surveys, 2) winter adult spawning surveys, and 3) minnow trapping. All three validation project types receive snorkel surveys three years after implementation. Adult spawning surveys are limited to fish passage projects (FP and HB). Spawning surveys can be completed the first

winter after implementation and continue until fish or redd presence is documented above the former barriers. Juvenile snorkel surveys are also done in both impact and control reaches during BACI monitoring. Fish densities are calculated by dividing fish numbers by square feet (length x width) of the pool.

Minnow trapping is conducted when snorkel surveys are not a suitable option due to poor water quality or visibility, or to document for winter non-natal rearing.

Juvenile Snorkel Validation Surveys

Snorkel surveys are used to determine juvenile salmonid presence (or absence) and density in stream reaches directly associated with instream features (often LW) or upstream of migration barrier removal locations. Snorkel dives are typically performed during the same site visit as effectiveness monitoring, both immediately prior to project implementation (pre-treatment) and three years after implementation (post-treatment). Snorkeling protocols were adapted from Duffy (2005) and Garwood and Ricker (2017).

For HB and FP projects, up to five pool units are randomly selected immediately upstream and downstream of a migration barrier removal location. For HI projects, up to five randomly selected pool and/or run habitat units adjacent to proposed LW structure locations are selected for snorkeling at pre-treatment and revisited following three winters. Minimum qualifications to snorkel habitat units include maximum residual depth ≥ 0.8 feet (ft), average wetted width ≤ 16.4 ft, and visibility ≥ 4 ft. If the average wetted width of a pool or flatwater run is ≥ 16.5 ft, maximum depth must be ≥ 1.5 ft.

Each unit is surveyed from downstream to upstream by one diver in a single pass (to minimize fish and sediment disturbance) during daylight hours. A waterproof flashlight is used to view undercut banks or other dimly lit areas. Fish are identified to species when able, grouped by age class, and enumerated. Age class designation is assigned according to visually estimated lengths: 0-3 inches (in) = young-of-year (YOY); 3-6 in = 1+ years of age; > 6 in = 2+ years of age. Physical dimension measurements (average width, maximum length, and maximum residual water depth) for each unit are recorded. Air and water temperatures are recorded at each site prior to entering the water and again if water temperatures could increase to stressful levels (> 68° F).

Coho Salmon (*Oncorhynchus kisutch*) and steelhead trout (*Oncorhynchus mykiss*) are the primary targeted species for validation monitoring; however, Chinook Salmon (*Oncorhynchus tshawytscha*) and coastal cutthroat trout (*Oncorhynchus clarkii clarkii)* are also recorded. Chinook Salmon may be underrepresented because surveys are often conducted after most juveniles have begun migrating to the ocean.

BACI Surveys

The BACI monitoring protocol used by MESHR was adapted from the Washington State Salmon Recovery Funding Board (Crawford 2011) and the U.S. Environmental Protection

Agency (Kaufmann et al. 1999). The intent of BACI is to determine whether the addition of LW structures provides improvements to stream habitat over time based on analysis of standardized, repeatable measurements such as LW volume, channel substrate, residual water depth, residual pool depth, and juvenile fish relative abundance.

Projects are monitored more intensively and for a longer period than effectiveness assessments, with habitat and fish parameters measured prior to treatment, and after treatment at one, three, five, and 10 years later. During pre-treatment, impact and control reaches are selected, physical habitat parameters are recorded, and juvenile salmonid numbers are estimated during snorkel surveys.

All qualifying pool and run habitat units in both the control reach and impact reach are snorkeled from downstream to upstream. Fish are identified to species, grouped by age class, and enumerated following methods described earlier for juvenile snorkel validation monitoring. Air and water temperatures are recorded at the start of each reach and may be repeated if conditions suggest a measurable change.

Minnow Trapping Surveys

The goal of minnow trapping surveys is to determine juvenile salmonid presence and density in stream reaches directly associated with migration barrier removal locations or instream features when snorkeling is not a viable option. Up to five minnow traps are baited with sterilized salmon roe and left in calmer water with cover. Individual traps are deployed for approximately two hours and all fish captured are documented and released. Salmonid lengths are also recorded.

Adult Spawning Validation Surveys

Adult spawning surveys record counts of total redds, live fish, and carcasses in reaches immediately upstream and downstream of a barrier removal location. Live fish and carcasses are identified by species and sex, if possible. If multiple surveys within the season are planned (especially for complete barrier projects), identified redds are marked with flagging indicating the date and redd number to avoid re-counting redds in later surveys.

Habitat parameters are recorded along standard reach lengths of approximately 20 bankfull channel widths tracked using a Garmin™ GPS 60CSx unit or Avenza Maps. Stream flows can also be tracked using a USGS proxy gauge from a nearby stream. If a surveyed reach does not contain suitable spawning habitat, landowner permission may be pursued for surveys further upstream of the standard 20 bankfull channel widths. Data from spawner surveys conducted by partners presented in this report may use different methods, including surveys of different stream lengths than those conducted by MESHR.

Validation Monitoring Project Selection

The 2023 effectiveness monitoring selection by MESHR designated five new projects to receive pre-treatment validation monitoring, but four of the five projects were postponed until 2024 or later. An additional six projects previously selected and postponed were eligible for validation monitoring in 2023, but three of these four were postponed again until 2024 or later. Three projects not postponed received pre-treatment validation monitoring and are summarized in Table 18. One project (Q2140408 - Potrero Creek Fish Passage Lower Culvert Project - Carmel Valley Athletic Club, Carmel Valley) did not receive pre-treatment validation monitoring due to dry conditions.

Table 18. Restoration projects receiving validation during pre-treatment monitoring in 2023.

Grant #	Project Type	Project Title	Grantee	Status
Q2110505	FP	Scott Bar Mill Creek Fish Passage Improvement Project	California Trout Inc.	Pre-treatment snorkel validation completed by MESHR.
Q2210506	HR	Lower Stotenburg Coho Habitat Enhancement Project	Smith River Alliance	Pre-treatment minnow trapping completed by MESHR
Q2140409	FP	Weston-Champagne Cachagua Creek Fish Passage Project	Resource Conservation District of Monterey County	Pre-treatment snorkel validation completed by MESHR

Five projects received post-treatment validation monitoring and one project had BACI juvenile surveys conducted. One project scheduled for validation monitoring, Fish Passage and Off-Channel Habitat Restoration at Roy's Pools, could not be validated due to low water depth and poor water quality. Two projects received spawner surveys to document possible fish passage above previous barriers. All post-treatment projects included in 2023 validation monitoring are summarized in Table 19. This 2023 validation monitoring report includes data collected from January 1 to December 31, 2023.

Table 19. Restoration projects that received post-treatment validation monitoring in 2023.

Grant #	Project Type	Project Title	Grantee	Status
P1810503	FP	Gulch C Coho Salmon Fish Passage Improvement Project	Trout Unlimited, Inc.	Post-treatment snorkel validation completed by MESHR.
P1610504	HI	James Creek Coho Stream Habitat Enhancement Project	California Conservation Corps	Post-treatment snorkel validation completed by MESHR.
P1710529	FP	Little Springs Migration Barrier Removal	Northwest California Resource Conservation & Development Council	Post-Treatment minnow trapping completed by MESHR.
P1730411	HB	Fish Passage and Off-Channel Habitat Restoration at Roy's Pools	Salmon Protection and Watershed Network	Post-treatment snorkel validation not completed due to poor water quality.
Q1910513	HI	East Branch North Fork Big River Coho Habitat Enhancement Project - Large Wood Installation	California Conservation Corps	Post-treatment snorkel validation completed by MESHR.
P1010321	FP	Walton Gulch Bridge Project	California Department of Forestry & Fire Protection Legacy	Post-treatment spawner survey eighth winter after barrier removal by MESHR.

Grant #	Project Type	Project Title	Grantee	Status
P1010508	FP	Dunn Creek Fish Passage Project	Mendocino County Resource Conservation District	Post-treatment spawner survey eleventh winter after barrier removal by MESHR.
P1510523	FP	Fish Passage Improvements at South Fortuna Boulevard	City of Fortuna	Post-treatment minnow trapping fifth winter after barrier removal by MESHR.

Results

Young-of-year trout can be progeny of steelhead trout, resident rainbow trout, coastal cutthroat trout, or a rainbow trout and cutthroat trout hybrid. Although steelhead trout are often the most abundant trout at restoration sites, trout juvenile identification at this size can be inaccurate. Unless otherwise specified, we will refer to all juvenile trout observations as trout.

Pre-Treatment Snorkel Survey Observations

The following projects received pre-treatment snorkel validation monitoring in 2023:

- Q2110505 - Scott Bar Mill Creek Fish Passage Improvement Project
- Q2140409 - Weston-Champagne Cachagua Creek Fish Passage Project

Scott Bar Mill Creek Fish Passage Improvement Project (FP)

This project proposed to restore Coho Salmon access to three miles of habitat in the Scott River. Proposed treatment includes eliminating a partial rock barrier at the confluence by extending lower Mill Creek. Removing a cement crossing 200 feet upstream of the mouth that is a full barrier and replacing it with a free span bridge was also part of the proposal.

On June 27, 2023, five pools were snorkeled, four below the bridge and one above. Coho Salmon were only present in the two lowest pools, but trout were observed throughout, including nine trout above the barrier (Table 20).

Table 20. Scott Bar Mill Creek Fish Passage Improvement Project pre-treatment snorkel validation survey data.

Avg Area Surveyed (ft^2)	Avg Max Residual Depth (ft)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)	Unknown Salmonid species	Unknown Salmonid (Fish/ft^2)
225.4	1.06	82	6	3	0.081	8	0	0.0070	1	0.0010

Weston-Champagne Cachagua Creek Fish Passage Project (FP)

This project proposed to remove a partial barrier to steelhead migration on Cachagua Creek by removing an existing concrete ford and replacing it with a single span bridge. This will restore access to 8.3 miles of upstream steelhead habitat.

Five habitat units were snorkeled within the treatment area, three below and two above the current crossing. The total area surveyed was 1,969 ft^2, with an average unit area of 393.8 ft^2 and average maximum residual depth of 1.1 ft. Juvenile trout were observed within every habitat unit snorkeled. A total of 156 trout were observed, with 85 trout observed below and 71 above the current barrier. The average density of trout throughout the surveyed units was 0.079 fish/ft^2 (Table 21).

Table 21. Weston-Champagne Cachagua Creek Fish Passage Project pre-treatment snorkel validation data.

Date	No. of Units Surveyed	Avg Area Surveyed (ft^2)	Avg Max Residual Depth (ft)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)
7/19/2023	5	393.8	1.1	152	4	0	0.0792

Post-treatment Snorkel Survey Observations

The following projects received post-treatment snorkel validation monitoring in 2023:

- P1810503 - Gulch C Coho Salmon Fish Passage Improvement Project
- Q1910513 - East Branch North Fork Big River Coho Habitat Enhancement Project - Large Wood Installation
- P1610504 - James Creek Coho Stream Habitat Enhancement Project

Gulch C Coho Salmon Fish Passage Improvement Project (FP)

The project restored access for adult and juvenile Coho Salmon and steelhead trout to approximately 1.3 miles of spawning and rearing habitat. Two salmonid migration barriers were replaced and improved the geomorphic function of Gulch C.

The pre-treatment surveys were completed in 2020 and the post-treatment surveys were completed in 2023. Total pools snorkeled increased from five to six at post-treatment though the length of stream sampled remained the same. Total area surveyed and average maximum residual depth decreased because of the removal of a large and deep plunge pool below the lower crossing that developed from a perched culvert. Fish numbers increased overall though all fish were observed below the lower crossing (Table 22).

Table 22. Gulch C Coho Salmon Fish Passage Improvement Project pre- and post-treatment snorkel validation survey data.

Date	No. of Units Surveyed	Avg Area Surveyed (ft^2)	Avg Max Residual Depth (ft)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)
6/2/2020	5	114.1	2.10	0	0	0	0	1	0	0.0018
5/31/2023	6	75.0	0.98	100	0	0	0.22	135	0	0.30

East Branch North Fork Big River Coho Habitat Enhancement Project - Large Wood Installation (HI)

This project improved the quality and quantity of spawning and rearing habitat for Coho Salmon and steelhead trout via installation of 38 instream features using 95 pieces of LW along a total of 5,455 feet (1.03 miles) of East Branch North Fork Big River.

Pre-treatment surveys were completed 06/09/2020 and post-treatment surveys were completed 08/28/2023. Five pools were surveyed at both pre- and post-treatment and average maximum residual depth increased since implementation. Average salmonid numbers per square foot remained the same or slightly increased (Table 23).

Table 23. East Branch North Fork Big River Coho Habitat Enhancement Project pre- and post-treatment snorkel validation survey data.

Date	No. of Units Surveyed	Avg Area Surveyed (ft^2)	Avg Max Residual Depth (ft)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)
6/9/2020	5	665	1.65	25	3	0	0.0084	64	0	0.019

Date	No. of Units Surveyed	Avg Area Surveyed (ft^2)	Avg Max Residual Depth (ft)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)
8/28/2023	5	572.8	2.48	9	6	0	0.0052	55	16	0.025

James Creek Coho Stream Habitat Enhancement Project (HI)

This project improved the quality and quantity of spawning and rearing habitat for Coho Salmon and steelhead trout via installation of 28 instream features using 93 pieces of LW along a total of 3,168 feet (0.88 miles) of James Creek.

Pre-treatment surveys were conducted 09/16/2019 and post-treatment surveys were conducted 06/15/2023. Five pools were surveyed at both pre- and post-treatment and both average survey area and average maximum residual depth increased since implementation. Trout numbers decreased in both total numbers and fish per square feet, while Coho Salmon increased in both (Table 24).

Table 24. James Creek Coho Stream Habitat Enhancement Project pre- and post-treatment snorkel validation survey data.

Date	No. of Units Surveyed	Avg Area Surveyed (ft^2)	Avg Max Residual Depth (ft)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ft^2)	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ft^2)
9/16/2019	5	733.8	1.72	70	1	0	0.019	73	0	0.020
6/15/2023	5	786.5	3.08	12	6	1	0.0048	131	19	0.038

BACI Snorkel Survey Observations

The following project received post-treatment BACI snorkel monitoring in 2023 in addition to post-treatment effectiveness monitoring.

P1610504 – James Creek Coho Stream Habitat Enhancement Project (HI)

The following project also received post-treatment BACI snorkel monitoring in 2023 (Table 25). Previous BACI data was collected in 2017 (Table 26), 2018 (Table 27), 2019 (Table 28), and 2021 (Table 29).

Table 25. James Creek Coho Stream Habitat Enhancement Project BACI post-treatment snorkel survey results from 2023.

Study Reach	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ft²)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft²)	Unknown Fish	Unknown Fish (Fish/ft²)
Impact	131	19	0.038	12	6	1	0.0048	1	0.00030
Control	114	10	0.028	6	0	1	0.0016	0	0

Table 26. James Creek Coho Stream Habitat Enhancement Project BACI pre-treatment snorkel survey results from 2017.

Study Reach	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft²)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft²)	Unknown Fish	Unknown Fish (Fish/ ft²)
Impact	0	0	0	67	10	4	0.12	0	0

Study Reach	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft²)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft²)	Unknown Fish	Unknown Fish (Fish/ ft²)
Control	0	0	0	73	6	0	0.14	0	0

Table 27. James Creek Coho Stream Habitat Enhancement Project BACI pre-treatment snorkel survey results from 2018.

Study Reach	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft²)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft²)	Unknown Fish	Unknown Fish (Fish/ ft²)
Impact	26	0	0.031	98	16	1	0.14	0	0
Control	6	1	0.015	60	19	2	0.17	0	0

Table 28. James Creek Coho Stream Habitat Enhancement Project BACI pre-treatment snorkel survey results from 2019.

Study Reach	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft²)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft²)	Unknown Fish	Unknown Fish (Fish/ ft²)
Impact	73	0	0.10	70	1	0	0.097	0	0
Control	20	0	0.035	24	1	0	0.044	0	0

Table 29. James Creek Coho Stream Habitat Enhancement Project BACI post-treatment snorkel survey results from 2021.

Study Reach	Coho Salmon YOY	Coho Salmon 1+	Coho Salmon (Fish/ ft^2)	Trout YOY	Trout 1+	Trout 2+	Trout (Fish/ ft^2)	Unknown Fish	Unknown Fish (Fish/ ft^2)
Impact	0	0	0	6	1	0	0.011	1	0.011
Control	0	0	0	0	1	0	0.0015	1	0.0015

Minnow Trapping Survey Observations

One project received pre-treatment minnow trapping surveys in 2023:

- Q2210506 - Lower Stotenburg Coho Habitat Enhancement Project

Lower Stotenburg Coho Habitat Enhancement Project (HR)

This project proposed to restore the lowest 0.5 miles of Stotenburg Creek and enhance connectivity with the Smith River. Treatments included beaver dam analogues, willow trenches, and LW structures. It also proposed to improve fish passage and increase winter rearing habitat, plus add cattle-exclusion fencing to protect riparian bank stability and water quality.

Minnow trapping was only able to be completed at the lowest pool just above the confluence with the Smith River due to lack of water. Four traps were placed around the large pool (approximately 3,000 ft^2 with an average depth of two feet) but only captured five stickleback and no salmonids (Table 30).

Table 30. Lower Stotenburg pre-treatment minnow trapping survey results.

Grant #	Project Title	Project Type	Date Surveyed	Trout YOY	Trout 1+	Coho Salmon YOY	Coho Salmon 1+	Other
Q2210506	Lower Stotenburg Coho Habitat Enhancement Project	HR	5/9/2023	0	0	0	0	5 stickleback

One project received a post-treatment minnow trapping survey in 2023:

- P1710529 - Little Springs Migration Barrier Removal

Little Springs Migration Barrier Removal (FP)

The objective of this project was to improve passage for Coho Salmon by replacing an undersized metal pipe culvert on East Louie Road. Treatment included a natural bottom multi-plate crossing structure and grade controls sufficient to maintain the existing stream profile and prevent incision upstream of the crossing.

At post-treatment four minnow traps were placed near the crossing, two above and two below. No fish were captured but unknown fish were visible from the surface (Table 31).

Table 31. Little Springs Migration Barrier Removal pre- and post-treatment minnow trapping survey results.

Monitoring Type	Date Surveyed	No. of Units Surveyed	Trout YOY	Trout 1+	Coho Salmon YOY	Coho Salmon 1+	Other
Pre	7/14/2020	6	0	0	0	0	20 Speckled Dace

Monitoring Type	Date Surveyed	No. of Units Surveyed	Trout YOY	Trout 1+	Coho Salmon YOY	Coho Salmon 1+	Other
Post	6/27/2023	4	0	0	0	0	None

One project received a post-treatment winter validation minnow trapping survey in 2023:

- P1510523 – Fish Passage Improvement at South Fortuna Boulevard

Fish Passage Improvement at South Fortuna Boulevard (FP)

An existing culvert was retrofitted with a notched bottom and a forty-foot roughened rock chute was added below the culvert. Fish passage was enhanced during low and high flows which provides access to 10.95 miles of historical habitat for Coho Salmon.

Four minnow traps were placed around the crossing, two above and two below. The only fish captured was one Threespine Stickleback above the crossing (Table 32).

Table 32. Fish Passage Improvement at South Fortuna Boulevard Winter minnow trapping survey results in 2023.

Project Type	Monitoring Type	Date Surveyed	No. of Units Surveyed	Trout YOY	Trout 1+	Coho Salmon YOY	Coho Salmon 1+	Other
FP	Post	3/27/2023	4	0	0	0	0	1 stickleback

Adult Spawning Survey Observations

Four projects received adult spawning surveys in 2023:

- P1810515 - Panther Creek Barrier Removal Project (FP)

- P1010321 - Walton Gulch Bridge Project (FP)
- P1010508 - Dunn Creek Coho Fish Passage Project (FP)

Panther Creek Barrier Removal Project (FP)

This project removed the remains of an abandoned road crossing and gauging station that restricted passage of salmonids and improved instream habitat conditions by installing four LW habitat structures. The barrier removal allows for year-round access for all life stages of Coho Salmon and other salmonids to approximately 4.5 miles of instream habitat.

Walton Gulch Bridge Project (FP)

This project removed an undersized and perched culvert barrier to Coho Salmon and steelhead trout and replaced it with an open bottom arch culvert. It opened access to approximately 4,000 feet of spawning and rearing habitat to all life stages of anadromous species. It also has capacity for a hundred-year flow event and the associated bedload and debris.

Dunn Creek Coho Fish Passage Project (FP)

This project removed three former culvert crossings which had been complete barriers to fish passage. Crossings were replaced by spanning bridges in 2011, providing access to 0.8 miles of fish habitat.

Adult spawning surveys observations results for all three projects are summarized in Table 33.

Table 33. Adult spawning survey observations from barrier removal projects sites conducted in 2023.

Grant #	Project Title	Project Type	Reach Length (ft)	Date Surveyed	Live Fish	Carcass	Redds
P1810515	Panther Creek Barrier Removal Project	FP	600	2/1/2023	0	0	0

Grant #	Project Title	Project Type	Reach Length (ft)	Date Surveyed	Live Fish	Carcass	Redds
P1010321	Walton Gulch Bridge Project	FP	1670	2/7/2023	0	0	0
P1010508	Dunn Creek Coho Fish Passage Project	FP	6100	2/8/2023	0	0	0

Discussion

Pre-treatment validation monitoring is essential to document baseline salmonid presence and density prior to restoration to compare it to post-treatment data. However, small changes in fish density from individual surveys can be due to daily, seasonal, or annual variability in fish relative abundance in a particular stream or stream reach. Larger sample sizes over a longer period are necessary for statistical analyses to determine if variability in fish densities is significant. Using available resources MESHR conducts pre- and post-treatment surveys under similar conditions (e.g., flow, temperature, visibility, or seasonal re-distribution of salmonids) to reduce variability in fish densities, but additional factors may affect salmonid distribution.

Juvenile Snorkel Validation and BACI Surveys (Pre- and Post-Treatment)

Only one project received pre-treatment snorkel validation monitoring in 2023, as seven projects scheduled for validation monitoring were postponed, and the Lower Stotenburg Coho Habitat Enhancement Project was monitored by minnow trap due to inadequate water depth for snorkeling.

Post-treatment juvenile snorkel validation monitoring was completed on three projects in 2023: James Creek Coho Stream Habitat Enhancement Project, Gulch C Coho Salmon Fish Passage Improvement Project, and East Branch North Fork Big River Coho Habitat Enhancement Project – Large Wood Installation. Little Springs Migration Barrier Removal is also a fish passage project, but validation was completed via minnow trapping. Fish Passage and Off-Channel Habitat Restoration at Roy's Pools was snorkeled at pre-treatment but not at post-treatment due to shallow water depth and bad water quality.

The James Creek Coho Stream Habitat Enhancement Project is an Instream Habitat Restoration project and showed increased average maximum residual depth post-implementation (+ 1.36 ft). Trout densities decreased from a pre-treatment average of 0.119 fish/ft^2 to 0.011 fish/ft^2 at post-treatment. Coho Salmon total numbers increased in the five pools surveyed but densities decreased from 0.044 fish/ft^2 to 0.038 fish/ft^2 due to increased pool sizes.

The Gulch C Coho Salmon Fish Passage Improvement Project is a Fish Passage project that removed a former barrier and improved grade. Average residual depth went down due to the removal of a perched culvert and resultant plunge pool. Trout densities increased at post-treatment from zero to 0.22 fish/ft^2 and Coho Salmon densities increased from 0.0018 fish/ft^2 to 0.30 fish/ft^2.

The East Branch North Fork Big River Coho Habitat Enhancement Project is an Instream Habitat Restoration project and showed increased maximum residual depths in snorkeled pools (+ 0.83 ft). Overall trout densities decreased from 0.008 fish/ft^2 to 0.005 fish/ft^2, while Coho Salmon densities increased slightly from 0.019 fish/ft^2 to 0.025 fish/ft^2.

Snorkel validation monitoring for BACI continued for James Creek in 2023 to document fish numbers for year 3 post-treatment. Coho Salmon numbers in year 3 increased substantially from year 1 post-treatment in 2021, after numbers had dropped off following construction, and were also higher than all three years of pre-treatment snorkeling. Coho Salmon numbers were highest at year 3 and lowest at year 1. However, Coho Salmon densities decreased in the impact reach from an average of 0.044 fish/ft^2 over three years of pre-treatment monitoring to 0.038 fish/ft^2 in year 3. In the control reach, Coho Salmon densities increased from 0.017 fish/ft^2 to 0.28 fish/ft^2. Total numbers increased in both reaches and were higher in the impact, indicating lower densities in the impact reach were driven by larger pool sizes.

Total trout numbers increased from year 1 to year 3 post-treatment but densities dropped from 0.011 fish/ft^2 to 0.0048 fish/ft^2. Trout numbers and densities have also not risen to the same levels documented over three years of pre-treatment monitoring. Trout numbers have been higher in the impact reach than the control in every survey year, but densities were lower in 2017 and 2018.

Minnow Trapping Survey

On March 27th, 2023, MESHR conducted a minnow trapping survey on South Fortuna Boulevard Fish Passage Improvement Project. Four traps were baited and set, two downstream of the South Fortuna Boulevard crossing and two upstream. No salmonids were caught during the survey (Table 32).

Adult Spawner Validation Surveys (Post-Treatment)

Documenting fish response to barrier removal or modification using spawner surveys is more informative for complete barrier removals than for partial or temporal barrier modifications or LW addition projects.

Re-colonization of habitat above former barriers by adult anadromous salmonids typically occurs within one to five years after barrier removal (Anderson and Quinn 2007, Kiffney et al. 2008, and Pess 2009). Success of validation spawner surveys depend on 1) availability of suitable spawning habitat above a former barrier, 2) discovery of this habitat by spawners, 3) overlap of run timing with time of spawner surveys, and 4) annual variability of run size and spawner distribution. All are important considerations when evaluating spawner survey data, particularly when sample sizes remain low in the first years after implementation. No evidence of fish above a barrier at pre-treatment followed by observed fish upstream after barrier removal suggests new habitat was opened by the project. However, confidence in re-occupation above the barrier would increase with more surveys during both pre- and post-treatment monitoring.

A survey conducted on Walton Gulch in February 2023 did not document any spawning activity above a former bridge barrier (Table 33). Spawner surveys are planned in the future to document possible spawning activity above the former barrier.

Steelhead spawning activity in Dunn Creek has been documented, including five redds in March 2015. Two redds and two carcasses (one identified as a steelhead) were observed in February 2016, and two potential steelhead redds in February 2018. The dates these redds and carcasses were found suggest these were all from steelhead trout spawning activities. Spawner surveys in 2019, 2020, and 2023 found no additional evidence of spawning (Table 33).

Effects and Benefits Discussion

Fish relocation activities were conducted on three implementation projects in 2023. A total of 5,804 salmonids were captured, including three SONCC coho salmon, 5,298 NC steelhead, and 503 CCC steelhead. Mortalities were limited to 46 NC steelhead (0.88% of captured) and seven CCC steelhead (1.4% of captured). No juvenile salmonids were captured, handled, or tagged during project monitoring activities. A total of 877 juvenile salmonids were observed during snorkel surveys and no negative fish response was observed. Across all projects 6,878 feet of aquatic habitat was disturbed by implementation construction activities.

These short-term effects will result in long-term benefits. For example, 253 instream structures were constructed within the stream channel. Three culverts were replaced or repaired, restoring access to 2.31 miles of previously unoccupied salmonid habitat. Over six acres of off channel habitat features were enhanced or created and approximately four miles of road was decommissioned. Validation and BACI surveys provided data to guide future restoration.

Brief case study reports that summarize project objectives and outcomes following post-treatment effectiveness and validation monitoring are made annually. Case studies for 2023 are presented in a separate file titled *Appendix_6_Case_Studies_RGP12_2023.pdf* submitted with this report and will be added to past projects on the CalFish website.

Bioengineering

The BO (section 2.5.6.1.8) requires CDFW to report to NMFS on all projects that use bioengineered bank stabilization methods. For each project that includes application of bioengineering, the length of bio-engineered streambank restored per project must be less than three times the active channel width of that project. No projects reported using bioengineering methods in 2023.

Variances

The BO (section 1.1.1.4) requires CDFW to provide NMFS with a narrative description of any requested variances from the limitations described in the Proposed Action and their resolution. No projects requested for variance in 2023.

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