2016 Year In Review

CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

Instream Flow Program

2016 Instream Flow Program Highlights

INSTREAM FLOW STUDIES

Introduction to Instream Flow Studies..... 2

California Water Action Plan

- Ventura River 3
- Mill Creek 3
- South Fork Eel Watershed..... 4

Butte Creek 5

Coastal Streams Study..... 6

OUTREACH

Quality Assurance Program..... 7

Instream Flow Methodologies..... 8

Presentations and Publications..... 9

LOOKING AHEAD

2017 Performance Objectives 10

All photographs in this report were taken by CDFW staff.

This page: Deer Creek (Tehama County)

Cover page, clockwise from top left: Carmel River (Monterey County); Redwood Creek (Humboldt County); Elder Creek (Mendocino County)

Instream Flow Studies

The California Department of Fish and Wildlife's (CDFW) Instream Flow Program (IFP) develops instream flow studies to inform water managers about the flows needed for fish rearing, spawning, migration, and habitat suitability. This report summarizes accomplishments completed by the IFP in 2016.

Instream flow studies are important to:

- assess the **amount and timing of water flow** needed to maintain healthy aquatic resources;
- form the **scientific basis** for future instream flow work; and
- provide **recommendations and actions** regarding instream flows and the impacts of water rights allocations.

CDFW instream flow efforts include performance reviews of studies by non-IFP staff or contractors, consultation regarding study plans with agencies or other organizations conducting studies, and development of associated recommendations from studies not performed by the IFP. In 2016, the IFP was involved with multiple studies supporting the California Water Action Plan and Public Resources Code (PRC) §10000-10005 mandate, and participated in additional studies and technical advisory committees.

California Water Action Plan Studies

- Ventura River (Ventura County)
- Mill Creek (Tehama County); also a PRC study stream
- South Fork Eel Watershed (Humboldt and Mendocino Counties)

Public Resources Code §10000-10005 Studies

- Butte Creek (Butte County)
- Deer Creek (Tehama County)
- Big Sur River (Monterey County)

Other Instream Flow Study Participation

- Coastal Streams Study (multiple counties)
- Carmel River (Monterey County)

Technical Advisory Committee Involvement

- Sproul Creek (Humboldt County)
- Pismo Creek (San Luis Obispo County)
- Antelope Creek (Tehama County)

Ventura River dry pool (top);
Seely Creek, SF Eel Watershed (bottom)

CA Water Action Plan

The state must manage water while balancing three elements: public health and safety, protecting the environment, and supporting the economy. With this in mind, the California Water Action Plan (CWAP) was developed to move California toward a more sustainable water management system. CDFW and the State Water Resources Control Board (SWRCB) are implementing a suite of actions, as part of Action 4 of the CWAP, to enhance flows statewide in at least five priority watersheds that support critical habitat for threatened and endangered anadromous fish.

In support of the CWAP, in 2016 the IFP began Ventura River study planning, developed a technical document for the instream flow study on Mill Creek, and completed Redwood Creek field work. Redwood Creek is a tributary to the South Fork Eel River.

Ventura River (Ventura County)

Once home to one of the largest steelhead (*Oncorhynchus mykiss*) runs on the south coast, the Ventura River is considered one of four major steelhead-bearing watersheds in the Southern California Steelhead Recovery Plan (NMFS 2012). The Ventura River was identified as a high-priority watershed, providing important habitat needed to maintain the overall health and recovery of endangered Southern California steelhead (southern steelhead).

IFP staff prepared a study plan to investigate instream flow needs in the Ventura River. Study components involve evaluating critical passage locations in the mainstem Ventura River, and assessing spawning, rearing, riffle productivity, and habitat maintenance flows in San Antonio Creek. Critical to southern steelhead recovery, San Antonio Creek is the only known tributary in the lower mainstem that supports spawning and rearing habitats. The selection of study methods will vary among individual reaches due to the importance and diversity of southern steelhead habitats encompassed by the watershed.

Upper Ventura River (top); Lower Ventura River (bottom)

Mill Creek (Tehama County)

Mill Creek supports a self-sustaining, wild population of threatened spring-run Chinook Salmon (*Oncorhynchus tshawytscha*), as well as Central Valley steelhead and fall-run Chinook Salmon. Due to persistent insufficient instream flows and elevated stream temperatures during summer months, Mill Creek was identified as a priority stream for developing passage flow recommendations.

The study evaluated passage conditions at depth sensitive, low gradient riffles. Hydraulic habitat modeling and species- and lifestage-specific depth criteria were used to assess critical riffles, and water temperature modeling was incorporated. A technical document detailing the results of the study was developed, and will be available in early 2017.

Survey autolevel in Mill Creek

South Fork Eel Watershed (Humboldt and Mendocino Counties)

The South Fork Eel Watershed supports populations of threatened Coho Salmon (*Oncorhynchus kisutch*), Chinook Salmon, and steelhead. Although the South Fork Eel River was historically a prolific breeding ground for Southern Oregon/Northern California Coast Coho Salmon, the number of independent populations has continued to decrease. Altered flow regimes, increased water temperatures, and loss of habitat complexity have limited salmonid production (CWPAP 2014).

Currently, IFP staff are evaluating the flow necessary to improve fish habitat in the South Fork Eel Watershed. Data collected in Redwood Creek and Hollow Tree Creek, two tributaries to the South Fork Eel River, will be used to better understand impacts to salmonids and to enhance flows.

Redwood Creek

The degradation and loss of summer freshwater habitat is one of the leading causes of Coho Salmon decline in the Redwood Creek watershed. Suitable summer flows are likely to have a profound effect on juvenile Coho Salmon rearing. The goal of the Redwood Creek study is to enhance stream flows to support juvenile salmonid rearing habitat. In 2016, the IFP habitat mapped 17 river miles within the watershed, comprising ten distinct river reaches. A total of 105 representative transects were installed to evaluate habitat conditions. Transects were visited 462 times with 423 water surface elevations surveyed and 135 distinct discharges measured. Streamflow and temperature were monitored with pressure transducers at seven locations throughout the watershed. Data collected will be used to model and assess flows necessary to support juvenile rearing in the Redwood Creek Watershed.

7 Pressure transducers installed

17 River miles habitat mapped

105 Transects installed

Hollow Tree Creek

In 2016, the IFP began Hollow Tree Creek preliminary data collection to develop regional habitat suitability criteria (HSC) for rearing juvenile salmonids. Habitat mapping and site reconnaissance were completed. To develop HSC, the suite of physical habitat conditions required during different life stages must be determined. This information is identified by surveying fish habitat use and/or avoidance, as well as habitat characteristics such as water depth and velocity. In 2017, data will be collected using field-based techniques, including fish snorkel surveys and classification of habitat.

Juvenile steelhead and marker, Hollow Tree Creek

Butte Creek

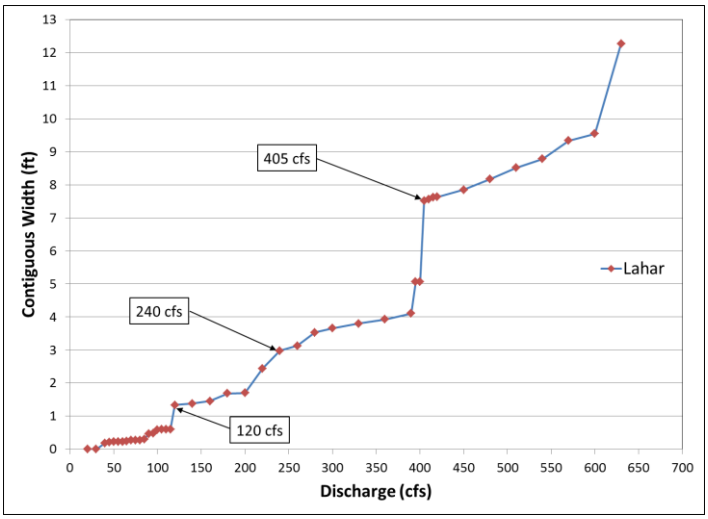
(Butte County)

Butte Creek sustains the largest wild population of spring-run Chinook Salmon (SRCS) in the Sacramento River watershed. The IFP investigated passage conditions for SRCS due to concerns over fish stranding downstream of an exposed bedrock formation in the lower watershed.

The bedrock formation, also known as the Lahar, forces water to flow through a braided network of narrow gullies. As flows recede, pathways through the network begin to disconnect, and passage opportunities are restricted. A two-dimensional model was developed to assess potential passage pathways. Modeling results indicated that the amount of stream width available for adult fish passage increases dramatically at several discrete and relatively narrow ranges of flow.

Butte Creek bedrock formation

The passage assessment was completed in 2016. The technical report **Instream Flow Evaluation of Upstream Spring-run Chinook Salmon Passage in Butte Creek, California** is posted on the IFP webpage. Results of the study were also published in the scientific journal *River Research and Applications*. The article, titled **Evaluation of Central Valley Spring-run Chinook Salmon Passage Through Lower Butte Creek Using Hydraulic Modeling Techniques**, can be accessed at http://onlinelibrary.wiley.com/doi/10.1002/rra.3098/full.



Discharge versus width with depth ≥ 0.9 ft at Lahar site, Butte Creek

Information from the technical study will be used to generate flow criteria with consideration of local watershed hydrology. Draft flow criteria are currently under review, and will be released for public comment in spring 2017.

Spring-run Chinook Salmon, Butte Creek

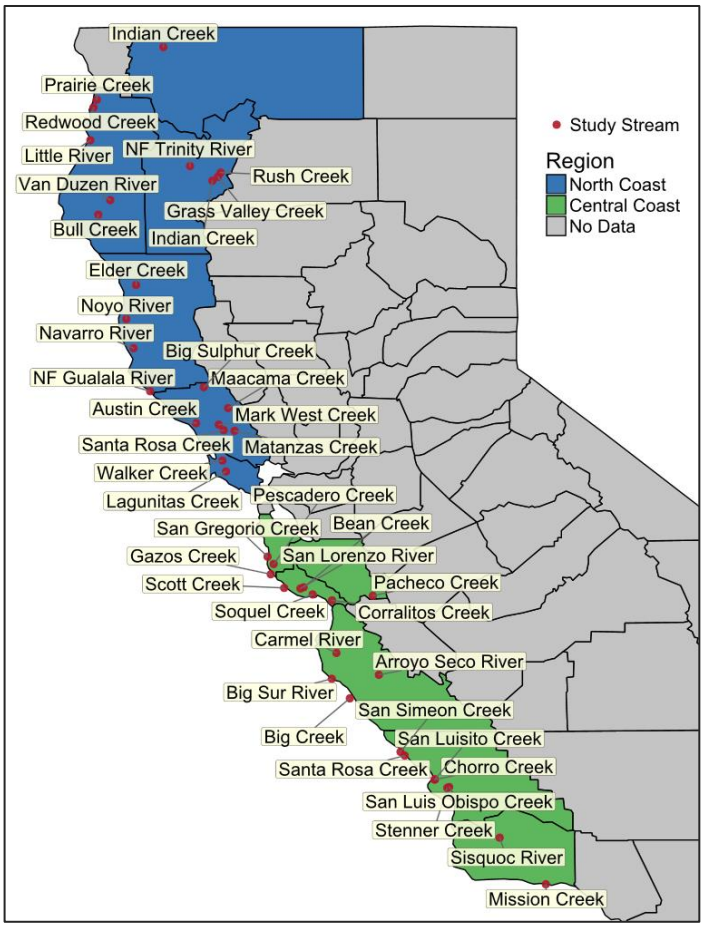
Coastal Streams Study

(Multiple Counties)

In lotic environments, water quantity and quality are intricately linked; both play a vital role in maintaining the health of stream-dwelling organisms. However, water quantity and quality are often assessed independently. Collaborative efforts among agencies to pool different data sources can greatly enhance our understanding of the physical requirements of stream biota, and can improve management strategies for imperiled species.

The IFP collaborated with staff from the Central and North Coast Regional Water Quality Control Boards to identify 43 coastal streams to conduct rapid flow assessment studies. The overall goal of the project was to integrate flow requirements into watershed health report cards that currently focus solely on water quality. Streams were selected based on the presence of steelhead and long-term (10+ years) flow data.

In total, study streams spanned 12 counties, from Siskiyou County in the north to Santa Barbara in the south. Representative riffle transects were selected in each of the streams to determine ecological flow thresholds (e.g., benthic macroinvertebrate production or steelhead passage). Existing flow data will be used to determine how frequently flow thresholds are exceeded for different water year and/or month types. The IFP anticipates completing analyses for all streams by fall 2017.



Map of north and central coast study streams

Navarro River, Mendocino County (top);
Stenner Creek, San Luis Obispo County (bottom)

Quality Assurance Program

The management of instream flow is complicated. Since instream flow criteria support water management decisions, the quality of data collected is paramount. In partnership with the Quality Assurance Team at the Marine Pollution Studies Laboratory (MPSL) at Moss Landing Marine Laboratories, the IFP's Quality Assurance (QA) Program was developed to enhance the transparency, accountability, and scientific defensibility of instream flow data collection, analysis, and reporting.

To support the production of defensible, comparable, and useable data, the QA Program and MPSL developed a full-day training on Instream Flow Study Design and Execution for CDFW staff. The training session reviewed QA concepts and applications, and the use of common flow methods related to the five core riverine components as recognized by the Instream Flow Council.

The training described multiple essential factors that should be considered in the creation and implementation of an instream flow study, which included:

- Selecting study-appropriate methods and models
- Establishing strong relationships between habitat and flow
- Generating defensible instream flow criteria and recommendations that are supported by data of known and documented quality
- Verifying and validating instream flow data

Five core riverine components (Annear et al. 2004)

The training also highlighted desktop formulas, empirical analyses, and hydraulic computational models used in California. These applications are used to determine different types of instream flows, including:

- Low flow thresholds
- Salmonid passage, spawning, and rearing flows
- Riffle (benthic invertebrate) productivity flows
- Habitat maintenance flows
- Channel forming (flushing) flows
- Subsistence flows

The QA program emphasizes that methods selected should be based on the study question(s) and included in detailed study plans. Some considerations in choosing instream flow methods are discussed on the following page.

Instream Flow Methodologies

The IFP supports the use of a variety of defensible methods to quantify flow regimes for fish, wildlife, and their habitats. There are many verified methods to choose from, ranging from quick standard setting desktop tools, to intensive site-specific hydraulic modeling procedures. Components of hydrology, biology, geomorphology, water quality, and connectivity, and the relationships between them, must all be considered. Since riverine processes are dynamic and complex, there is no single method or model that can incorporate all potential variables. The IFP encourages instream flow practitioners to consider the suite of tools available when developing flow regimes.

Comprehensive, site-specific analyses, like the Instream Flow Incremental Methodology, generally provide the most robust and defensible analysis of flow needs for a particular species and life stage. However, not all situations are conducive to this approach. Standard setting methods can be considered when cost-effective and time-sensitive techniques are needed. These methods typically involve desktop, rule-of-thumb procedures to set limits below which water cannot be diverted. Desktop methods often rely on availability of historical water supply information, are generally appropriate for reconnaissance level planning or low controversy projects, and can also provide a basis of comparison to other methods.

Another advantage of standard setting methods is that important life stages, such as fish migration, spawning, and rearing, can be assessed with a basic level of confidence. However, it is still important (as it is with site-specific approaches) to use appropriate methods for the questions that need to be answered. Some of the common standard-setting methods and types of flows they can provide are below. To learn more, we recommend **Instream Flows for Riverine Resource Stewardship** (Annear et al. 2004). Standard operating procedures on select methods are also available on the IFP website at https://www.wildlife.ca.gov/Conservation/Watersheds/Instream-Flow/SOP.

Standard Setting Methods	Salmonid Rearing	Salmonid Passage	Salmonid Spawning	Ecological Riffle Productivity	Low-Flow Threshold	Survival Flows	Channel Maintenance Flows	Drought Flows
Habitat Retention Method		X		X	X	X		
Wetted Perimeter Method				X	X			
Qfp		X						
Hatfield-Bruce Equations	X		X					
Flow Duration Analysis								X
Percentile-based Flow Criteria					X		X	X
Channel Maintenance Flows							X	

Presentations and Publications

Presentations

Cowan, W. (2016). Instream Flow Evaluation, Lower Butte Creek. Workshop and Tour. Salmonid Restoration Federation Spring-run Chinook Symposium, Chico, CA. July 26-28 2016.

Haas, D. (2016). Overview of the CDFW Instream Flow Program. California Flow Restoration Meeting, Sacramento, CA. April 29 2016.

Haas, D. (2016). Evaluating Passage Conditions and Instream Flows for Salmonids in Lower Deer and Mill Creeks. Salmonid Restoration Federation Spring-run Chinook Symposium, Chico, CA. July 26-28 2016.

Holmes, R. (2016). Overview of the Big Sur River Instream Flow Study and Draft Instream Flow Recommendations for Protection of Steelhead in the Big Sur River. Stakeholder Meeting, Grange Hall, Big Sur, CA. March 24 2016.

Publications

CDFW (2016). Common Methods and Models for Quantifying Flow Regimes for Fish and Wildlife. Instream Flow Program Fact Sheet, Winter 2016.

CDFW (2016). Standard Operating Procedure for the Habitat Retention Method in California. California Department of Fish and Wildlife Instream Flow Program Standard Operating Procedure DFG-IFP-006, 26 p. Available at: http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=128310&inline

Cowan, W. R., D. E. Rankin, and M. Gard. (2016). Evaluation of Central Valley Spring-Run Chinook Salmon Passage Through Lower Butte Creek Using Hydraulic Modelling Techniques. River Research and Applications. Available at: http://onlinelibrary.wiley.com/doi/10.1002/rra.3098/full

Many resources, including presentations and publications, can be found on our Instream Flow Program website, which was revised in early 2016. Descriptions of current studies, standard operating procedures, historical documents, technical reports, and other links are also available.

Access the Instream Flow Program website at:
https://www.wildlife.ca.gov/Conservation/Watersheds/Instream-Flow

Indian Creek, Siskiyou County

2017 Performance Objectives

Priority CWAP streams, PRC studies, and coordination and implementation of projects statewide will guide instream flow activities in 2017.

- Instream flow activities for the CWAP priority streams will continue.
  - Ventura River: The study plan will be finalized, and applicable data will be collected, QA/QC checked, and analyzed.
  - Mill Creek: The technical report will be finalized, followed by the instream flow criteria report.
  - South Fork Eel Watershed: Data QA/QC and analyses will be completed for Redwood Creek, and the technical report will be drafted. Site selection and field work will begin in Hollow Tree Creek for HSC development.
  - Mark West Creek: Regional coordination and study planning activities will begin.
- Instream flow criteria reports will be finalized for PRC studies in the Big Sur River and Butte Creek. A Deer Creek technical report and subsequent flow criteria report will also be completed.
- Data analyses for the coastal streams study will be completed, followed by development of a technical report.
- The IFP will continue consultation with the SWRCB on their effort to develop long- and short-term cannabis principles and guidelines, which must ensure cannabis water diversions and discharges do not affect instream flows for fish and their habitat.
- Coordination and outreach efforts will continue on a quarterly basis with the SWRCB, National Marine Fisheries Service, US Fish and Wildlife Service, and Regional Water Quality Control Board. Public and stakeholder engagement will be supported by continuing outreach efforts.
- The IFP will continue to participate in and present instream flow study findings at seminars and workshops across the state. When feasible, study results will be submitted for publication in peer-reviewed literature.

References

Annear, T., I. Chisholm, H. Beecher, A. Locke, and 12 other authors (2004). Instream flows for riverine resource stewardship, revised edition. Instream Flow Council, Cheyenne, WY.

CWPAP (2014). The South Fork Eel River Assessment Report. Coastal Watershed Planning & Assessment Program (CWPAP). Available at: http://coastalwatersheds.ca.gov/tabid/739/Default.aspx

NMFS (2012). Southern California Steelhead Recovery Plan. National Marine Fisheries Service (NMFS), Southwest Regional Office. Long Beach, CA.

We never know the

worth of water

till the well is dry.

- Thomas Fuller

California Department of Fish and Wildlife

Instream Flow Program

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