



2024 Year in Review

The California Department of Fish & Wildlife

INSTREAM

FLOW PROGRAM



2024 Year in Review

The California Department of Fish and Wildlife (Department) Instream Flow Program (IFP) conducts instream flow studies and develops ecological flow criteria needed for long-term protection, maintenance, and effective stewardship of fish and wildlife resources.

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Figure 1. The five riverine components (from Annear et al. 2004¹).

All photographs in this report are owned by the Department or Department staff.

Cover page (clockwise from top left): West Fork San Gabriel River in Los Angeles County; Navarro River in Mendocino County; Upper China Creek, tributary to the South Fork Eel River, in Humboldt County; Scotts Creek, tributary to Clear Lake, in Lake County.

¹ Annear, T., I. Chisholm, H. Beecher, A. Locke, P. Aarrestad, C. Coomer, C. Estes, J. Hunt, R. Jacobson, G. Jobsis, J. Kauffman, J. Marshall, K. Mayes, G. Smith, R. Wentworth and C. Stalnaker (2004). Instream flows for riverine resource stewardship. Revised edition. Instream Flow Council, Cheyenne, WY.

Priority Streams Update

In order to protect public trust resources as well as fulfill legislative mandates put forward in the CA Water Action Plan², the CA Salmon Strategy³, and the Public Resources Code Division 10⁴, the IFP develops flow criteria for use in water management planning and decision-making processes. In 2024, the IFP continued studies that will provide flow criteria to support fish, wildlife, and water management goals for streams and rivers identified as priority streams. For more information on priority streams, visit the IFP website⁵.

Each streamflow analysis (Figure 2) provides meaningful instream flow criteria at key points in the watershed utilizing hydrologic models to assess natural flows, functional flows, and ecosystem baseflows to assess aquatic habitat over a range of flows.



² CNRA, CDFA and CalEPA (2016). California Water Action Plan 2016 update. California Natural Resources Agency (CNRA), California Department of Food and Agriculture (CDFA), and California Environmental Protection Agency (CalEPA), Sacramento, CA. Available: http://resources.ca.gov/docs/california_water_action_plan/Final_California_Water_Action_Plan.pdf.

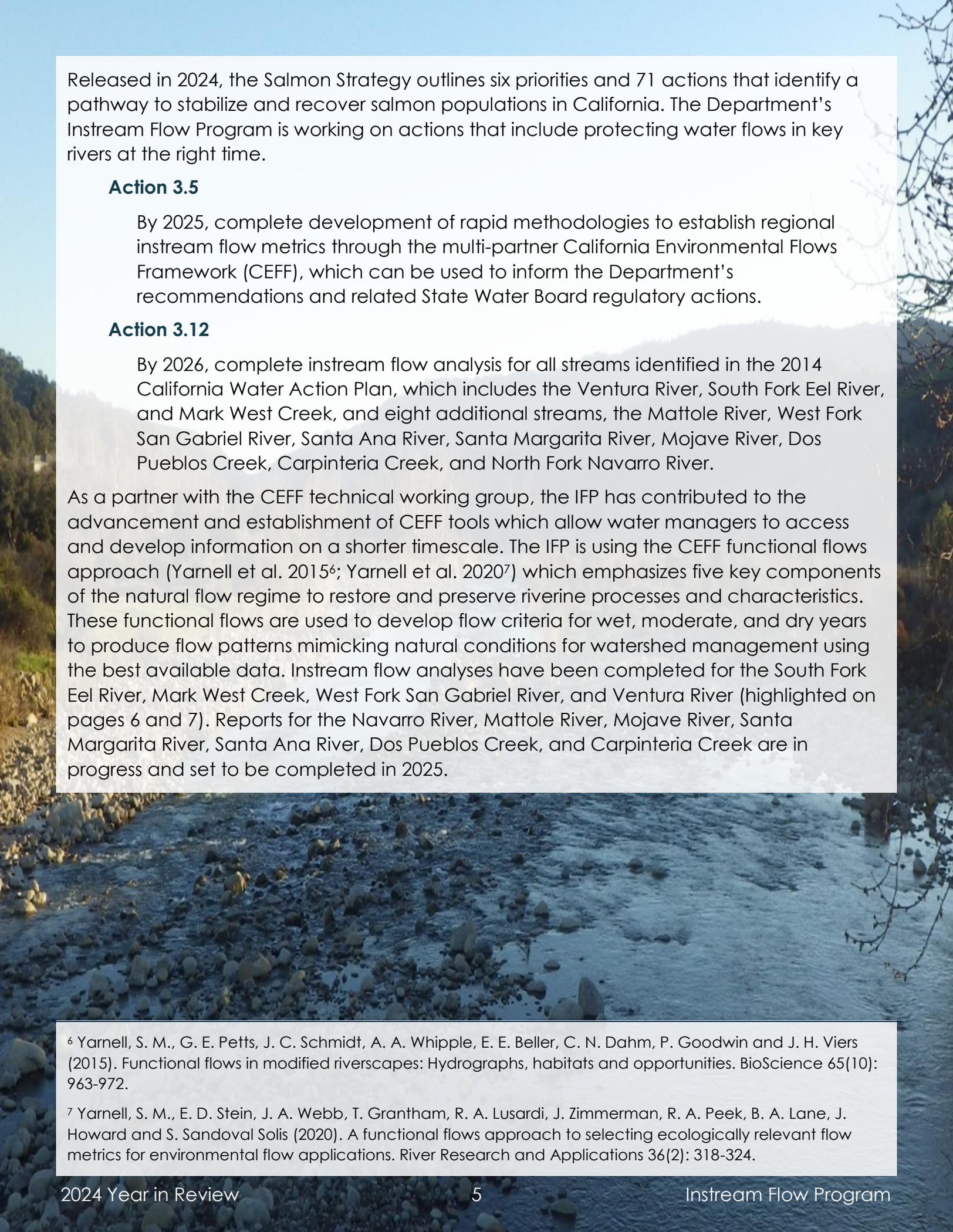
³ Office of Governor Newsom (2024). California Salmon Strategy for a Hotter, Drier Future: Restoring Aquatic Ecosystems in the Age of Climate Change. State of California. Available: <https://www.gov.ca.gov/wp-content/uploads/2024/01/Salmon-Strategy-for-a-Hotter-Drier-Future.pdf>.

⁴ Public Resources Code Division 10: <https://law.justia.com/codes/california/2010/prc/10000-10005.html>.

⁵ Instream Flow Program's website: <https://wildlife.ca.gov/Conservation/Watersheds/Instream-Flow>.



Figure 2. Map of priority watersheds.



Released in 2024, the Salmon Strategy outlines six priorities and 71 actions that identify a pathway to stabilize and recover salmon populations in California. The Department's Instream Flow Program is working on actions that include protecting water flows in key rivers at the right time.

Action 3.5

By 2025, complete development of rapid methodologies to establish regional instream flow metrics through the multi-partner California Environmental Flows Framework (CEFF), which can be used to inform the Department's recommendations and related State Water Board regulatory actions.

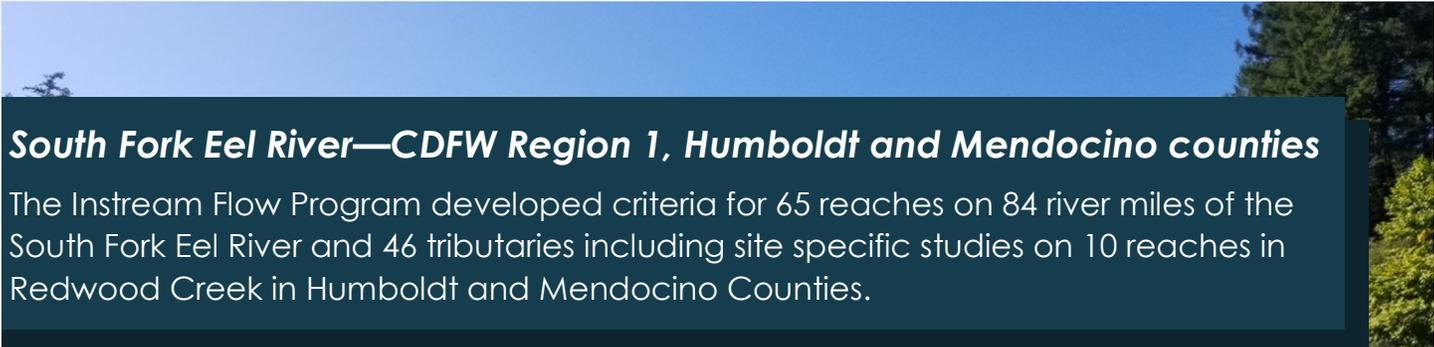
Action 3.12

By 2026, complete instream flow analysis for all streams identified in the 2014 California Water Action Plan, which includes the Ventura River, South Fork Eel River, and Mark West Creek, and eight additional streams, the Mattole River, West Fork San Gabriel River, Santa Ana River, Santa Margarita River, Mojave River, Dos Pueblos Creek, Carpinteria Creek, and North Fork Navarro River.

As a partner with the CEFF technical working group, the IFP has contributed to the advancement and establishment of CEFF tools which allow water managers to access and develop information on a shorter timescale. The IFP is using the CEFF functional flows approach (Yarnell et al. 2015⁶; Yarnell et al. 2020⁷) which emphasizes five key components of the natural flow regime to restore and preserve riverine processes and characteristics. These functional flows are used to develop flow criteria for wet, moderate, and dry years to produce flow patterns mimicking natural conditions for watershed management using the best available data. Instream flow analyses have been completed for the South Fork Eel River, Mark West Creek, West Fork San Gabriel River, and Ventura River (highlighted on pages 6 and 7). Reports for the Navarro River, Mattole River, Mojave River, Santa Margarita River, Santa Ana River, Dos Pueblos Creek, and Carpinteria Creek are in progress and set to be completed in 2025.

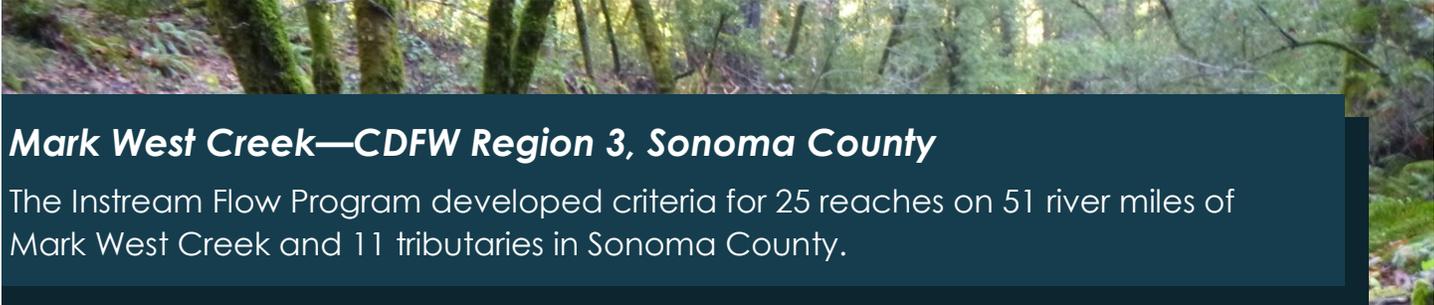
⁶ Yarnell, S. M., G. E. Petts, J. C. Schmidt, A. A. Whipple, E. E. Beller, C. N. Dahm, P. Goodwin and J. H. Viers (2015). Functional flows in modified riverscapes: Hydrographs, habitats and opportunities. *BioScience* 65(10): 963-972.

⁷ Yarnell, S. M., E. D. Stein, J. A. Webb, T. Grantham, R. A. Lusardi, J. Zimmerman, R. A. Peek, B. A. Lane, J. Howard and S. Sandoval Solis (2020). A functional flows approach to selecting ecologically relevant flow metrics for environmental flow applications. *River Research and Applications* 36(2): 318-324.



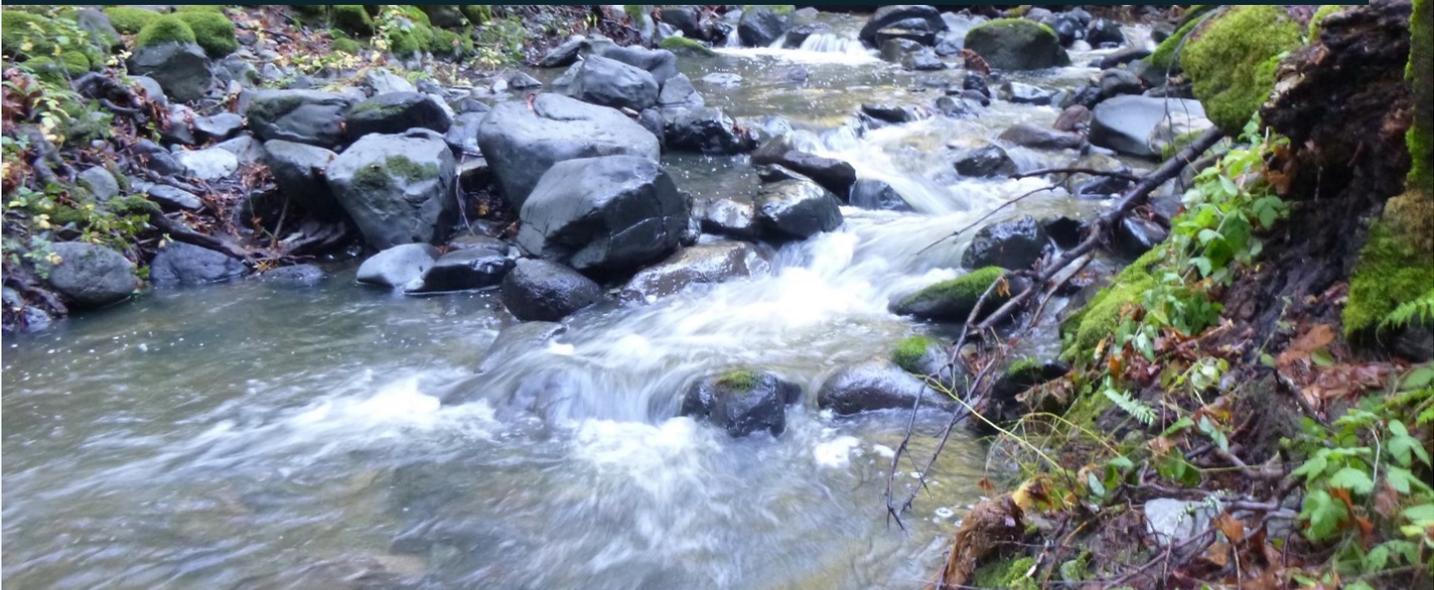
South Fork Eel River—CDFW Region 1, Humboldt and Mendocino counties

The Instream Flow Program developed criteria for 65 reaches on 84 river miles of the South Fork Eel River and 46 tributaries including site specific studies on 10 reaches in Redwood Creek in Humboldt and Mendocino Counties.



Mark West Creek—CDFW Region 3, Sonoma County

The Instream Flow Program developed criteria for 25 reaches on 51 river miles of Mark West Creek and 11 tributaries in Sonoma County.





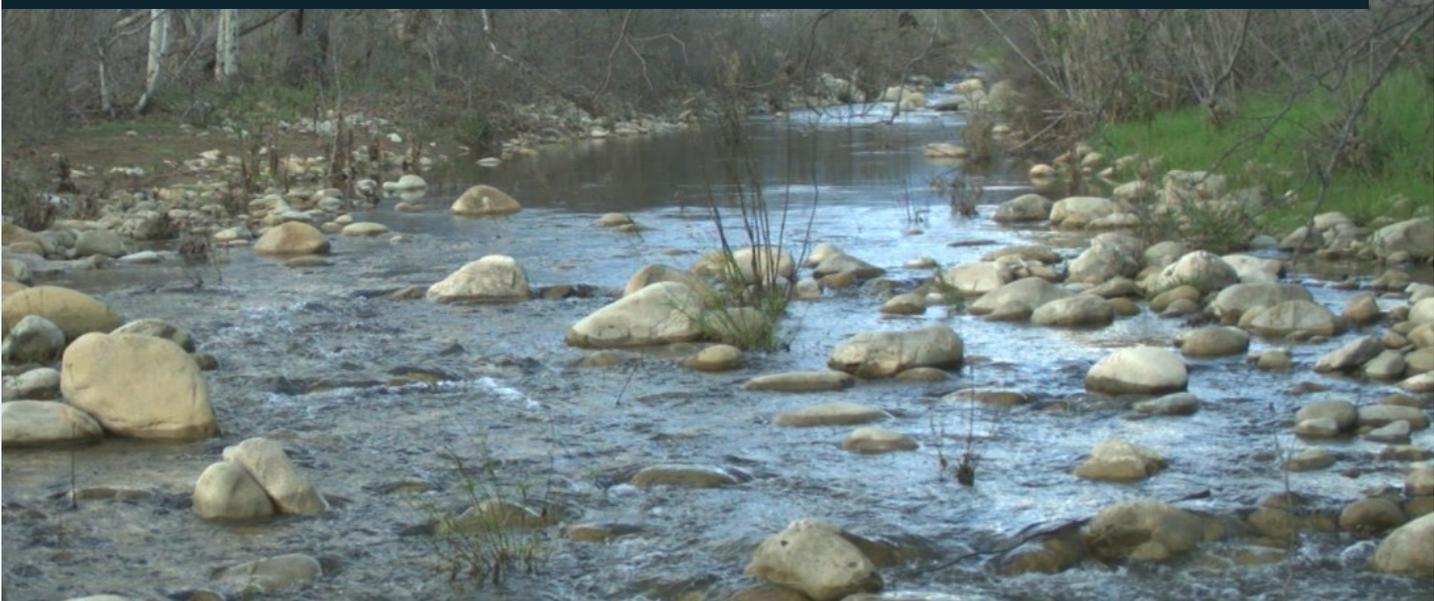
West Fork San Gabriel River—CDFW Region 5, Los Angeles County

The Instream Flow Program developed criteria for 29 reaches on 38 river miles of the West Fork San Gabriel River and 20 tributaries in Los Angeles County.



Ventura River—CDFW Region 5, Ventura and Santa Barbara counties

The Instream Flow Program developed criteria for 18 reaches on 19 river miles of the Ventura River and six tributaries in Ventura and Santa Barbara Counties.



Clear Lake Watershed

Located in the North Coast Mountain Range within Lake County, the Clear Lake watershed is bounded by mountainous regions and valleys spread throughout and along the lake's shores. The tributaries surrounding Clear Lake provide critical habitat for the Clear Lake Hitch (*Lavinia exilicauda chi*; CLH). The CLH is a culturally significant, large freshwater minnow endemic to the Clear Lake watershed, which migrates to the tributaries for spawning in the spring season when dry stream beds become inundated from seasonal rains (Feyrer 2019⁸). Modifications to the watershed such as agricultural and urban developments have altered stream beds and streamflow patterns. In addition to these alterations, climate, water diversions, and groundwater-surface water interactions have prompted streams to dry prematurely early in the spawning season, reducing access to critical habitat within the tributaries during the CLH's spawning, juvenile rearing, and outmigration period.

The CLH was listed on the California Endangered Species Act list as a threatened species in 2014. Additionally, in early 2025 the U.S. Fish and Wildlife Service proposed to list the CLH as a threatened species under the Endangered Species Act of 1973.

The Department is conducting an instream flow study of the Clear Lake watershed to address Governor Newsom's 2023 Executive Order N-5-23⁹, directing an evaluation of instream flows to protect the CLH. In 2024, the IFP began data collection and analysis on Middle, Scotts, Manning, Adobe, Kelsey, and Cole Creeks (Figure 3) to evaluate minimum instream flows for CLH passage. The goal of this study is to inform water resource decisions



Clear Lake Hitch (*Lavinia exilicauda chi*)

and protect instream flows to support critical habitat for CLH. The IFP is collaborating with the State Water Resources Control Board¹⁰, the Department's North Central Region, Fisheries Branch, Conservation Engineering Branch, and several government partners including California Native American Tribes in the Clear Lake region as well as local, state, and federal agencies. The IFP collected approximately 37 river miles of field data in 2024 and acquired, through a contract with NV5, over 50 river miles of topobathymetric light detection and ranging (lidar) data and aerial photography. The IFP is using two-dimensional (2D) hydraulic modeling to simulate flow conditions in tributaries over a range of targeted flows. Passage conditions will be evaluated using velocity, depth, and width criteria for CLH.

⁸ Feyrer, F. (2019). Observations of the spawning ecology of the imperiled Clear Lake Hitch. California Fish and Game 105(4): 225-232.

⁹ Executive Order N-5-23: <https://www.gov.ca.gov/wp-content/uploads/2023/03/3.24.23-Drought-update-executive-order.pdf>.

¹⁰ SWRCB Clear Lake Hitch website: <https://waterboards.ca.gov/clearlakehitch/>.

Data collected in 2024 in the Clear Lake watershed includes:

- Lidar survey to map the tributaries' topographic and bathymetric terrain at high-resolution (1.5-foot pixel resolution).
- Topographic data collection with a real time kinematic (RTK) and total station to supplement areas that were not picked up by the lidar survey due to thick overhead canopies and structures.
- Discharge (cfs) sampling using HACH FH950 flow meters.
- Validation measurements of depth (feet) and velocity (cfs) using a HACH FH950 flow meter to assess the predictive capability of the 2D hydraulic model.
- Water's edge locations using a RTK global positioning system (GPS) to calibrate the 2D hydraulic model on each tributary.
- Structure surveys for the 2D hydraulic model measuring the shape and elevations of major bridge crossings and instream structures such as culverts using a stadia rod, measuring tape, and RTK GPS equipment.
- Wolman pebble count surveys using a gravelometer to estimate streambed roughness for the 2D hydraulic model.

For more information, see the *Instream Flow Evaluation for Clear Lake Hitch Passage in Tributaries of the Clear Lake Watershed* study plan on our program's website¹¹.



¹¹ The IFP Clear Lake watershed page: <https://wildlife.ca.gov/Conservation/Watersheds/Instream-Flow/Studies/Clear-Lake-Watershed-Studies>.

Cannabis Program Support

The IFP continued its role participating in the development and implementation of the [California Environmental Monitoring and Assessment Framework](#) (CEMAF). In 2024, the CEMAF team conducted aquatic monitoring at 27 sites across nine watersheds in CDFW Regions 1 and 3¹¹. Eight of these watersheds have been monitored in previous years, while one new watershed in the Upper Napa River was added this year.

The CEMAF technical team piloted three new monitoring protocols in 2024: environmental DNA (eDNA) sampling, nitrogen and phosphorus sampling, and the use of timelapse imagery to estimate relative flow throughout the water year. Data collected during eDNA sampling are being processed in collaboration with the CDFW [Genetics Research Laboratory](#) and [CALeDNA](#), with the goal of assessing

species presence and community diversity. The CDFW [Water Pollution Control Lab](#) is analyzing the nitrogen and phosphorus data collected to help identify potential drivers of eutrophication and assess the risk to biological integrity. Stream timelapse imagery is captured according to best practices outlined by the United States Geological Survey (USGS) [Flow Photo Explorer](#) and uploaded to their website. Models developed from these images will generate relative flow measurements throughout the season, allowing streamflow monitoring year-round.

In 2025 CEMAF intends to further refine sampling protocols and expand to select watersheds in the Department's Region 2¹².



Environmental DNA (eDNA) sample collection.



CEMAF scientist collecting benthic macroinvertebrates following SWAMP protocols.

¹² CDFW regional map, visit: <https://wildlife.ca.gov/Regions>.

Quality Assurance and Training

Quality Assurance and Quality Control

The IFP is committed to collecting, analyzing, and reporting high quality, consistent, and defensible data for use in decision making processes. In 2024, the IFP continued quality assurance (QA) efforts by implementing the Quality Assurance Program Plan (QAPrP) developed last year and ensuring all program staff are up-to-date on necessary trainings.

Staff Training

In anticipation of the Clear Lake Hitch study, IFP staff reviewed use of topographic equipment and safety protocols. In February 2024, IFP staff practiced setup and use of real-time kinematic global positioning system (RTK-GPS) devices, which were used for topographic surveying throughout the Clear Lake watershed. IFP staff also met in March 2024, to go over updates to our Garmin inReach user protocol and IFP Health and Safety Plan. A short activity followed, where staff practiced using the inReach to navigate to predetermined waypoints.



Presentations and Publications

CDFW (2024). *Informational Public Meeting presenting the Draft study plan: Instream flow evaluation for Clear Lake Hitch passage in tributaries of the Clear Lake Watershed, Lake County*. February 7, 2024. Available at: https://www.youtube.com/watch?v=mvZ86Gslm_8&ab_channel=CaliforniaDepartmentofFishandWildlife.

Cowan, W. (2024). *1D and 2D hydraulic modeling in Dry Creek*. Virtual presentation at the Instream Flow Council Region 1 Workshop. January 24, 2024.

Cowan, W., M. Gard, and J. Rinde (2025). *Instream flow evaluation: upstream passage of Clear Lake Hitch in tributaries of the Clear Lake Watershed, Lake County*. California Department of Fish and Wildlife, Instream Flow Program (CDFW), West Sacramento, CA. Available at: <https://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=219934&inline>.

Drescher, B. and H. Casares (2024). *The Importance of a quality assurance program: a CDFW perspective*. Virtual presentation at the Instream Flow Council Region 1 Workshop. January 24, 2024.

Haas, D. and R. Holmes (2024). *Water management scenarios and discussion*. Virtual presentation at the Instream Flow Council Region 1 Workshop. January 24, 2024.

McDougall, L. (2024). *Wetted perimeter and habitat retention method analyses*. Virtual presentation at the Instream Flow Council Region 1 Workshop. January 24, 2024.

Milward, A. (2024). *Dry Creek desktop analyses*. Virtual presentation at the Instream Flow Council Region 1 Workshop. January 24, 2024.

Milward, A. and D. Haas (2024). *Developing flow regime recommendations—Dry Creek case study*. Virtual presentation at the Instream Flow Council Region 1 Workshop. January 24, 2024.

Obkirchner, G., I. Ralston, A. Maguire, J. Rinde, W. Cowan, and D. Haas (2024). *Instream flow evaluation for Clear Lake Hitch passage*. Virtual poster presentation at the Lake County Science Symposium. August 16, 2024.

Prowse, R. (2024). *Dry Creek discharge measurements*. Virtual presentation at the Instream Flow Council Region 1 Workshop. January 24, 2024.

Rinde, J., and G. Obkirchner (2024). *Instream flow methodologies to evaluate Clear Lake Hitch passage in tributaries of the Clear Lake Watershed*. Virtual presentation at the Lake County Science Symposium. August 16, 2024. Available at: https://www.youtube.com/watch?v=Z7hLAM3zmlg&ab_channel=LakeCountyWaterResourcesDepartment.

2025 Performance Objectives

Instream Flow Program activities in 2025 will focus on completing studies already underway, continuing efforts to develop watershed-scale flow criteria for priority streams and providing regional support in the face of climate uncertainty. Continued coordination with regional staff, stakeholders, and other project collaborators will be critical to completing ongoing projects.

- ⇒ Continue instream flow analyses on priority streams¹³ to protect and enhance public trust values consistent with Governor Newsom's Salmon Strategy¹⁴.
- ⇒ Perform instream flow assessments to support watersheds impacted by cannabis through the California Environmental Monitoring and Assessment Framework (CEMAF).
- ⇒ Provide hydrological and flow-related technical support to regional staff.
- ⇒ Continue to participate in the California Environmental Flows Framework (CEFF) workgroup and partnership to further refine available instream flow tools and application of the CEFF statewide.
- ⇒ Maintain quality assurance activities, document generation, and training in support of consistent, comparable, and defensible flow studies and information development.
- ⇒ Continue coordination and outreach efforts with the State Water Resources Control Board, National Marine Fisheries Service, US Fish and Wildlife Service, the Regional Water Quality Control Board, and other agencies.
- ⇒ Support public and stakeholder engagement by continuing outreach efforts.
- ⇒ Participate in and present instream flow study findings at meetings and workshops across the state.
- ⇒ Continue to build partnerships with California Native American Tribes to support streamflow enhancement for native species.

¹³ [Public Resources Code Division 10](#) streams and [Executive Order N-5-23](#) for Clear Lake watershed.

¹⁴ California Salmon Strategy for a Hotter, Drier Future: <https://www.gov.ca.gov/wp-content/uploads/2024/01/Salmon-Strategy-for-a-Hotter-Drier-Future.pdf>.

*“Mother Earth is not
a resource, she is an
heirloom.”*

- David Ipina, Yurok Tribe



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