

**THOMAS P. KEEGAN**  
*Senior Fisheries Scientist*

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Thomas Keegan has over 24 years experience as a fisheries biologist and aquatic ecologist. Mr. Keegan specializes in evaluation of impacts from water development projects to special-status fish species, in particular, Southern California steelhead, northern populations of steelhead, winter-run and spring-run Chinook salmon, coho salmon, tidewater goby, delta smelt, and Sacramento splittail. He has special expertise in the early life history and instream/estuarine habitat requirements of the above species, and Sierran trout populations. Mr. Keegan has managed numerous stream restoration projects, including watershed assessments, fish passage evaluations, aquatic habitat investigations, and aquatic bioassessments. He has extensive experience in population viability analysis, aquatic habitat mapping and assessment, benthic macroinvertebrate assessments (CDFG CSBP protocols), PHABSIM output review modeling, and development of habitat vs. discharge relationships.

Mr. Keegan also has expertise in environmental policies and regulations, including CEQA, NEPA, Section 404 of the Clean Water Act, and the state and federal endangered species acts. He has extensive experience in EIR/EIS and EA preparation, initial study/negative declaration and FONSI preparation, alternatives development and analysis, mitigation design, mitigation monitoring preparation, adaptive management, and regulatory permit processing. He routinely designs and conducts impact assessments for permitting of water development projects, including FERC Exhibit E documentation (hydroelectric relicensing), NPDES permitting, NEPA/CEQA documentation, RWQCB 401(c) certifications, and ESA Biological Assessments and Consultations. Mr. Keegan has conducted numerous Biological Assessments and Section 7 consultations, for both salmonids (e.g., anadromous salmonids, winter-run Chinook salmon, coho salmon, and steelhead) and non-salmonids (e.g., tidewater goby, delta smelt, Sacramento splittail, and Lost River, short nose, and Klamath suckers).

**Selected Professional Experience**

- Co-authored fisheries or aquatic resources sections for over 50 EIS, EIR, EA and Negative Declaration documents, including as examples the East Span Bay Bridge Seismic Retrofit Project, the Gualala Aggregate Mining Project in Sonoma County, the Unocal Rodeo Refinery Deep Water Outfall, the Deer Creek Hills General Plan Amendment and Rezoning, the Southport Wastewater Treatment Plant in Yolo County, and Cachuma Project Water Contract Renewal EIR/EIS,
- Managed numerous Biological Assessments, including "Section 7" consultation and "incidental take" permits for water development projects throughout California pursuant to the federal ESA.
- Currently conducting a two-year juvenile steelhead and coho salmon population assessment and enhancement plan in the lower Gualala River

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**EXHIBIT** CT 3

and Estuary, in partnership with the California Coastal Conservancy, Sotoyome Resource Conservation District, and Gualala River Watershed Council. The goal is to identify habitat conditions and timing and use by salmonids during each sampling event, and to describe the changes in physical habitat conditions among sampling events. The study effort includes monthly fish and benthic community monitoring, and collection of water quality parameters from May 2002 through October 2003. Bathymetry, freshwater inflow, sediment input, marine inter-relationships and vegetation mapping, (including wetland surveys adjacent to the estuary are additional study elements.

- Currently managing San Mateo Creek Steelhead Restoration Project in the Cleveland National Forest, upstream of Camp Pendleton, for the Southern California ESU steelhead. The first phase of the Project focuses on mapping suitable steelhead habitat, mapping threatened and endangered aquatic and terrestrial species (arroyo toad, southwestern flycatcher, least Bell's vireo, and several plant species) and testing of methods for removal of exotic aquatic resources. This project is coordinated with ongoing restoration activities in Camp Pendleton.
- Currently managing five-year fisheries (steelhead and fall run Chinook salmon), stream geomorphology, wildlife and vegetation monitoring project for the City of Fairfield's Green Valley Creek Restoration Project. Elements of the monitoring effort include: channel stability, sediment input, fish habitat mapping, fish species assemblage, fish passage and salmonid spawning, stream channel geomorphic mapping, success of riparian, marsh and grassland plantings, and avian habitat use.
- Conducted steelhead habitat assessment and juvenile population estimation sampling program in Malibu Creek, and coordinated efforts among agencies and a local municipal water district to preserve and enhance steelhead habitat in Malibu Creek.
- Developed a master plan for steelhead and riparian restoration in Rodeo Creek, California, in conjunction with the Contra Costa County Advisory Committee and Flood Control District. Conducted an aquatic assessment of Rodeo Creek habitat to determine suitability of steelhead habitat restoration.
- Managed and investigated federally-listed steelhead and coho salmon resources in the Gualala River for three additional, but separate projects: Conducted an assessment of the effects of pumped groundwater withdrawal on downstream steelhead habitat using the PHABSIM model for Sea Ranch and Gualala River Water Agency; Investigated effects of gravel mining in the Gualala River on steelhead habitat and prepared a focused EIS for Gualala Aggregates and the County of Sonoma; Investigated effects of past timber harvest practices steelhead and coho salmon habitat for Gualala Redwoods. Directed fish

population studies, habitat mapping, temperature monitoring, and PHABSIM modeling for the above projects.

- Recently completed affects assessment on aquatic habitat and coordinated cleanup of a sediment release from Weber Reservoir into Weber Creek, El Dorado County. Estimated sediment deposited along a ten-mile reach Weber Creek, and conducted extensive aquatic habitat mapping, and fish and benthic macroinvertebrate Bioassessment (CDFG CSBP protocols. Managed permitting activities, including COE nationwide 32, RWQCB 401 certification, vegetation restoration planning, and USFWS California red-legged frog biologic assessment. Prepared cleanup plan, and provided ESA oversight during sediment cleanup activities.
- Assessed the potential of six coastal streams in the Santa Monica Mountains as candidates for steelhead restoration, using habitat quality and suitability of fish passage as criteria.
- Co-designed steelhead trapping facilities in the Vern Freeman Diversion Fishway on the Santa Clara River for United Water Conservation District, and designed and managed a multi-year upstream and downstream steelhead migrant passage mitigation monitoring plan for the water district.
- Managed a Biological Assessment on the federally listed steelhead and California freshwater shrimp resources of Stemple Creek (Sonoma County) for the US Coast Guard Training Center.
- Reviewed and revised the steelhead and Chinook salmon potential impacts and mitigation measures sections for the Sonoma County Aggregate Resources Management Plan for the Russian River.
- Developed a steelhead enhancement plan for San Luis Obispo Creek in central California as part of an injury settlement offer after a large marine oil spill.
- Conducted a biological Assessment on the effects of roadway and bridge improvements on steelhead resource habitat in San Francisquito Creek on the Stanford University campus (EIS).
- Prepared a Biological Assessment on special-status species (steelhead and tidewater goby) for the Pajaro Valley Water Management Agency Import Pipeline and Coastal Distribution System, performed a fatal flaw analysis and an alternatives assessment of various pipeline configurations and system operations.
- Managed a three-phase stream restoration project for BP America on the upper Klamath River drainage in southern Oregon. Phase I consisted of assessing injury to a stream and its aquatic resources, particularly rainbow trout, from a dam breach; phase II consisted of preparing a biological assessment for dam

reconstruction in light of potential endangered species issues; phase III included developing and implementing stream remediation plans for agency and landowner approval.

- Conducted an assessment of steelhead habitat and other aquatic resources of Dry Creek for a proposed pipeline crossing for the Chamonix Golf Course, Roseville. Prepared impact evaluation and mitigation measures for the protection of threatened and endangered species (Chinook salmon and steelhead).
- Conducted habitat assessment and evaluation of steelhead and other aquatic resources (snorkel survey) in Miners Ravine adjacent to a proposed pipeline crossing. Potential impacts were determined and mitigation measures were incorporated into the CDFG Agreement Regarding Proposed Stream Alteration for the protection of threatened and endangered species (Chinook salmon and steelhead).
- FERC Hydroelectric Relicensing projects:
  - El Dorado Hydroelectric Project 184 (EID) – Primary Contractor to El Dorado Irrigation District, participating in FERC Settlement Collaborative, including representatives from FERC, federal, state, and local agencies, NGOs, and environmental groups. Managed all aquatic studies pertaining to relicensing of Project 184, including fisheries and fish habitat, benthic macroinvertebrate studies, geomorphology, water temperature modeling, reservoir bathymetry, IFIM (PHABSIM), and special-status amphibian surveys. Developed measurable Target Objectives for fish, benthic macroinvertebrates, amphibians, and habitat under the Adaptive Management Term and Condition of the Settlement Agreement.
  - El Dorado Hydroelectric Project 184 (EID) - Conducted post-construction monitoring (benthic macroinvertebrate assessment) for the South Fork American River Diversion dam and prepared documentation for RWQCB 401c certification.
  - Rock Creek – Cresta Hydroelectric Project (PG&E) – Conducted first year of fish population surveys under adaptive management conditions of the FERC Settlement Agreement
  - Rock Creek – Cresta Hydroelectric Project (PG&E) – Managed foothill yellow-legged frog surveys in Rock Creek and Cresta reaches of the mainstem North Fork Feather River and their major tributaries, using agency accepted PG&E protocols for visual encounter survey.
  - Upper North Fork Feather River Project (PG&E) – Conducted two years of fish entrainment sampling at four hydroelectric powerhouse tailraces of the Upper North Fork Feather River Project in support of FERC

relicensing. Built and installed site-specific sampling gear to assess seasonal entrainment mortality. Prepared Exhibit E document.

- Upper North Fork Feather River Project (PG&E) – Conducted three years of fish population surveys in streams and reservoirs associated with the Upper North Fork Feather River Project in support of FERC relicensing. Conducted backpack electroshocking in Belden and Seneca reaches, boat electroshocking in Lake Almanor, Butt Valley Reservoir, and Belden forebay, and gill netting in Lake Almanor. Prepared Exhibit E document.
- Upper North Fork Feather River Project (PG&E) – Prepared and implemented a contaminant sampling plan (fish tissue analysis) for a PCB spill related to the Upper North Fork Feather River Project. Designed site-specific sampling gear and methods to assess bioaccumulation of contaminants. Prepared ecological resources and human resources analyses from lab results for inclusion into Exhibit E document.
- Spring Gap-Stanislaus Project Entrainment Sampling (PG&E) – Prepared an entrainment sampling plan and conducted a feasibility study using fixed trawl and hydroacoustic sampling methods for determining entrainment at the Sand Bar Diversion Dam.
- Spring Gap-Stanislaus Project Entrainment Sampling (PG&E) – Conducted one season of entrainment sampling in the Sand Bar Diversion Canal using several fixed net designs, including modifications of the Kodiak trawl and framed trawls. Prepared analysis for presentation at SPLAT meetings. Managed engineering support services for construction of full canal frame and designed full canal net for future sampling effort in support of fish screen analysis.
- Upper North Fork Feather River Project (PG&E) – Conducted three years of benthic macroinvertebrate sampling using CDFG CSBP protocols for assessment of project-related effect bioassessment. Also conducted one year of macroinvertebrate drift sampling for determining effects of increased recreational flows on the aquatic community of the Feather River. Amphibian habitats were also assessed for effects of increased recreational flows.
- POE Hydroelectric Entrainment Studies (PG&E) - Designed and directed experimental fixed trawl technique (Kodiak trawl) for assessing seasonal fish entrainment through the POE Powerhouse on the Feather River as part of PG&E's relicensing requirement.
- Pit 4 Hydroelectric Entrainment Studies (PG&E) - Designed and directed experimental fixed trawl technique (Kodiak trawl) for assessing seasonal fish entrainment through the Pit 4 Powerhouse on the Pit River as part of PG&E's relicensing requirement.

- Kern River Nos. 1 and 3 Hydroelectric Projects, Southern California Edison - Assisted in the preparation of FERC Exhibit E and related environmental studies for the relicensing of two of Southern California Edison's hydroelectric projects on the North Fork Kern River, Tulare and Kern Counties, California. Supervised fish population data collection activities, and was responsible for integrating resulting analyses into the Exhibit E.
- Fish Response to Altered Flows (PG&E) - Participated in multi-disciplinary streamflow, habitat and aquatic resource studies for the long-term Fish Response to Altered Flows Investigation, an IFIM verification project for PG&E (funded through EPRI). Designed and implemented fish population and benthic macroinvertebrate sampling programs and creel census survey to partition population effects resulting from fishing mortality. Co-author of several annual project reports and special project reports.
- Potter Valley Hydroelectric Project (PG&E) - Conducted fisheries studies for relicensing of Potter Valley hydroelectric project on the Eel River, California. Task leader for downstream juvenile salmonid (steelhead and Chinook salmon) studies and field supervisor of salmonid escapement studies, juvenile salmonid rearing habitat assessments, and biomass estimation studies for a three-year minimum flow assessment.
- Balsam Meadows Project Entrainment Study, Southern California Edison - Co-developed and directed a state-of-the-art fish entrainment sampling program involving the use of hydroacoustic and fixed trawl monitoring methods for the Balsam Meadow Pumped Storage Facility. The objectives of the study were to quantify fish entrainment and to identify those fish species entrained through the Balsam Meadow Intake on Shaver Lake.
- Exhibit E Spawning and Production Surveys, Kerckoff Powerhouse (PG&E) - Implemented studies designed to investigate impacts from operation of the Kerckoff project to landlocked striped bass and American shad spawning in Millerton Lake and the San Joaquin River. Conducted beach seine, trawl and boat electrofishing sampling and boat-based and fixed net ichthyoplankton surveys.
- Exhibit E Salmonid Entrainment Sampling, Tiger Creek Powerhouse (PG&E) - Directed sampling effort designed to estimate salmonid entrainment from feeder streams into the Tiger Creek Powerhouse canal in the Mokelumne River drainage.
- Seattle City Light Salmonid Stranding Studies - Designed and directed a salmonid fry (including steelhead) stranding study downstream of SCL's hydroelectric facilities on the Skagit River, Washington, to determine seasonal downramping rates for protection of salmonid fry.

- Conducted Department of Water Resources (DWR) ichthyoplankton sampling for larval delta smelt in the vicinity of the Clifton Court forebay. This project was to determine location of delta smelt spawning and if ambient numbers of larval delta smelt in the forebay would preclude water exports.
- Designed and directed rainbow and brown trout habitat assessment and mapping survey of Bear Creek downstream of Big Bear Lake to assess alternative flow release schedules on the fisheries of Bear Creek.
- Project investigator of the fish and crustacean tasks for both the Unocal San Francisco Refinery and Chevron Richmond Refinery Deep Water Outfall NPDES monitoring programs, focusing on local effects of discharged process wastewater on the fisheries and benthos of San Pablo Bay and Carquinez Strait
- Conducted fishery and benthos investigations in support of Rhone-Poulenc process wastewater outfall NPDES in Suisun Bay.
- Conducted eelgrass bed delineation for a previously unknown bed for the new East Span Bay Bridge and Seismic Retrofit Project in San Francisco Bay and supplied Caltrans with a GPS generated map of the bed.
- Managed an impact assessment study on eelgrass, fishery and federally-listed California least tern resources in San Francisco Bay, resulting from constructing and operating a ferry terminal. Conducted an eelgrass bed delineation, baseline and monitoring surveys over five years to separate natural variability from actual project effects. Prepared a biological assessment for project-related construction and demolition impacts on special-status species, including winter-run Chinook salmon, delta smelt, green sturgeon and steelhead for the new East Span Bay Bridge and Seismic Retrofit Project in San Francisco Bay.
- Managed studies on the effects of dredging and dredge material disposal on federally-listed winter-run Chinook salmon in San Francisco Bay, produced a white paper and Biological Assessment focusing on risk assessment of resuspended contaminants from dredge material disposal on juvenile salmon for the Port of Oakland, conducted field hydroacoustic surveys investigating the vulnerability of San Francisco Bay fishes to contact with dredge material disposed at the Alcatraz dumpsite, used hydroacoustic sampling to detail real time plume characteristics of disposed dredge material and to identify fish avoidance behavior (i.e., fish movement in and out of the disposal area) for the SF Bay Transit Authority.
- Participated in 316 (a,b) demonstrations for PG&E powerhouses in San Francisco Bay and Delta. Conducted impingement and entrainment sampling at Contra Costa, Pittsburg, Portrero, and Hunter's Point power plants. Also conducted thermal effects sampling in the outfalls at Contra Costa and Pittsburg powerhouses.

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- Managed fishery injury determination studies for a large oil spill off Huntington Beach, California, for BP Oil and authored a white paper on the effects of the spill on California halibut populations.
- Managed immediate response activities for the Four Corners Oil pipeline rupture which occurred during the Loma Prieta earthquake in 1989. Assessed the effects to special-status fish species, such as the unarmored three-spine stickleback and the Santa Ana sucker, and their habitat and provided support to oil spill cleanup crews to minimize further impacts to sensitive species habitat.
- Project investigator for fish and invertebrate studies for the Shell Oil Company Martinez refinery oil spill in Suisun Bay, California. Designed and implemented a comprehensive fishery survey for determining impacts to the fisheries in Suisun Bay-Carquinez Strait.



## **Education**

- B.S. Fisheries Science, 1979. Humboldt State University, Arcata, California

## **Related Experience**

- Technical advisor of COE breaching study of a coastal lagoon (lakes Earl and Talawa, Crescent City), responsible for design and implementation of federally listed tidewater goby sampling survey and water quality monitoring.
- Past member of the Santa Ynez River Technical Advisory Committee composed of federal, state and local agency personnel and water purveyors, in support of SWRCB mandate and hearings. Designed and directed initial sampling efforts in the Santa Ynez River basin below Bradbury Dam for describing steelhead populations and habitat.
- Member of an interdisciplinary team, funded by the Association of California Water Agencies, investigating steelhead populations and associated limiting factors throughout the state of California. Mr. Keegan was responsible for Southern California steelhead populations. The goal of this project was to collect and review available stream-specific steelhead data and provide comment for the proposed federal steelhead listing package.
- Technical lead for a Report to Congress describing the biological and engineering feasibility of the USFWS Anadromous Fish Restoration Program, which identified action items designed to enhance (i.e., double) anadromous salmonid production in the tributaries of the Sacramento and San Joaquin river system (CVPIA Title 34).

