

POTENTIAL RESOURCE ISSUE:

Fish species composition, distribution and abundance.

PROJECT NEXUS:

Project operations and potential Project betterments modify or could potentially modify the flow regime and fish habitat in the bypass reaches and the peaking reach.

Changes in reservoir water surface elevations resulting from Project operations and potential Project betterments may affect fish habitat availability.

POTENTIAL LICENSE CONDITION:

- Instream flow releases.
- Modification of Project reservoir operations (reservoir water surface elevations).

STUDY OBJECTIVES(S):

- Document fish species composition, distribution, and abundance in the Project river reaches.
- Characterize fish growth, condition factor, and population age structure in the Project river reaches.
- Characterize fish species composition, relative abundance, and size in Project reservoirs and diversion pools.

EXTENT OF STUDY AREA:

The study area includes bypass and peaking reaches, comparison reaches upstream of Project facilities and diversions, and Project reservoirs and diversion pools. Specific study areas are identified in Tables AQ2-1 and AQ2-2 and Figure AQ2-1. Some portions of the study area are very difficult to access due to the rugged terrain (see Figure AQ1-1). Field data will only be collected in portions of the study area that are accessible.

STUDY APPROACH:

Study Sites

The locations of study sites for developing fish standing crop estimates (fish per mile and/or lbs per acre) in selected bypass, peaking, and comparison river reaches and for developing relative catch-per-unit-effort (CPUE) fish abundance in Project reservoirs and diversion pools are shown in Tables AQ2-1 and AQ2-2 and Figure AQ2-1. River sampling sites will generally be 100 meters long and will be sampled using electrofishing gear in shallow water (<1.5 m) and direct observation snorkeling in deep water. Some of the larger river sites (e.g., the lower Rubicon and Middle Fork American rivers) may require reaches up to 300 meters to be sampled to include multiple habitat types. The specific locations of the sampling sites will be determined in the field. The 2005-2006 mesohabitat mapping results (PCWA in progress) will be used to help identify a representative reach of river with mesohabitat types in similar proportion to the larger geomorphic reach of river. Where possible sampling sites will overlap instream flow study sites

(see the AQ-1 Instream Flow Technical Study Plan) and historic sampling sites (e.g., wild trout sampling data on the Rubicon River). The Aquatic Technical Working Group will be consulted during site selection. Where comparisons likely are to be made between locations upstream and downstream of Project facilities, study sites will be located in similar habitat types. The reservoirs will typically be sampled at three locations along the length of the reservoir using gillnets. The small diversion pools will be sampled by snorkeling.

### River Sampling

Quantitative river sampling will be conducted during the late summer/early fall base flow period. Multi-pass electrofishing (e.g., Reynolds 1996; Van Deventer and Platts 1989; Rexstad and Burnham 1992) will be used to sample and estimate fish populations in shallow stream habitats (<1.5 m) at each study site. Where possible, sampling sites will be partitioned into meso-habitat types for sampling using block nets. Captured fish from each pass will be kept in separate live wells or buckets. Fish will be enumerated, identified to species, measured (total length and weight), and scale samples will be obtained. Fish will be returned to the study site when the sampling is completed. Habitat data consistent with that collected during the 2005-2006 Aquatic Habitat Characterization Study (PCWA 2007) will be collected at the site. In particular, the lengths and widths of the habitat units sampled will be recorded to calculate fish abundance by length and area (density) of stream sampled.

Snorkeling (e.g., Dolloff et al. 1996) will be used to assess fish populations in deep water habitats ( $\geq 1.5$  m) at each study site. Snorkelers will survey in lanes along the river and will identify, count, and estimate the length of each fish observed. Fish data will be recorded by habitat unit and habitat information consistent with that collected during the 2005-2006 Aquatic Habitat Characterization Study (PCWA 2007) will be recorded.

Along the river reaches, between the quantitative study sites, qualitative presence/absence sampling may be used to identify the upstream distribution of fish species. Snorkeling will be used, if necessary, to spot check between the study sites to identify the approximate late summer/early fall distribution of hardhead. If necessary, qualitative sampling may also be used to identify the distribution of brown and rainbow trout.

### Reservoir Sampling

French Meadows, Hell Hole, and Middle Fork Interbay reservoirs will be sampled once during the late summer/early fall using variable mesh gillnets. Two nets will be placed at each of three locations along the length of the reservoir (upper, middle, lower). If possible, historical CDFG sampling sites will be included. Nets will be set for one day and one night. Fish will be enumerated, weighed, and measured (total length). The primary purpose of the sampling will be to identify fish species composition, relative abundance (CPUE), and size. Where possible wild fish and hatchery fish will be identified based on fin wear.

Ralston Afterbay will be sampled more intensively than the other Project reservoirs to help understand hardhead abundance and distribution, if present. The reservoir will be sampled twice; once in the late spring/early summer and once in early fall prior to the powerhouse maintenance drawdown. A combination of boat electrofishing along representative shoreline segments at night, gillnets, and sonar transects will be used to sample the reservoir. (Note: during the first sampling trip, a qualitative test of day versus night electrofishing will be conducted to guide future sampling). The objective of this sampling is to determine the relative abundance of fry, juvenile, and adult hardhead and their spatial distribution in the reservoir related to horizontal and vertical water temperature gradients, if present. Water temperature will be quantified at each sampling site. The fall sampling will be coordinated with the river population

sampling (above) to provide comparative data (i.e., relative abundance in the river sites compared to the reservoir).

### Diversion Pool Sampling

The Duncan Creek, North Fork Long Canyon, and South Fork Long Canyon diversion pools will be snorkeled once during the late summer/early fall. The number, species, and size of fish in the diversion pools will be identified.

### Special Purpose Qualitative Sampling

Qualitative sampling using electrofishing, hook-and-line, and/or seining gear may also be used for the following purposes:

- To collect additional trout and hardhead, if necessary, to develop age versus growth relationships in the Rubicon River (e.g., near Ellicott Bridge and above Ralston Afterbay) and in the Middle Fork American River below Ralston Afterbay where bioenergetics (temperature, food availability, and growth) may be an important issue. Scales from 50 rainbow trout, 50 brown trout, and 50 hardhead will be collected if fish are present and sufficiently abundant in these reaches for age and growth analysis (see AQ-5 Bioenergetics Technical Study Plan).
- To collect seasonal information on emergence of fry (i.e., to identify timing of spawning and early fry rearing). This sampling will occur in Duncan, North Fork Long Canyon, and South Fork Long Canyon creeks to identify the timing and abundance of fry in the vicinity of Project diversions. This will also occur upstream of Ralston Afterbay (Rubicon River and Middle Fork American River) to identify the approximate timing of hardhead spawning and early fry rearing in these reaches.

### Data Analysis

- Compare and contrast the fish standing crop estimates between study sites and with historic or published standing crop estimates (e.g., CDFG wild trout data, Gerstung 1973). The appropriate comparison datasets will be identified in collaboration with the Aquatic Technical Working Group.
- Develop a distribution map for each species in the bypass reaches and the peaking reach using the quantitative abundance estimates and qualitative sampling data.
- Develop a fish life stage periodicity chart (or life history chronology chart by month) for each species for each study reach based on available literature, consultation with qualified fisheries biologists, and the fish population sampling data.
- Develop length frequency histograms of sampled fish and examine distribution modality, in conjunction with scale data, to determine the age structure of fish populations.
- Summarize fish growth and age data using length frequency and scale analysis.
- Calculate fish condition factors using measured weight and length data.
- For reservoir fishes, compile existing information (including fish species assemblages from historic sampling, stocking records, and fishing success) and compare to data from this study.

### SCHEDULE:

To be developed in early 2007.

REFERENCES:

- Dolloff, A., J. Kershner, and R. Thurow. 1996. Underwater Observation. Pages 533-554 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.
- Gerstung, E. R. 1973. Fish population and yield estimates from California trout streams. *Cal-Neva Wildlife* 1973:9-19.
- Placer County Water Agency (PCWA). 2007. 2005-2006 Physical Habitat Characterization Report.
- Rexstad, E. and K. Burnham. 1992. User's Guide for Interactive Program CAPTURE. Colorado Cooperative Fish and Wildlife Research Unit, Colorado State University, Fort Collins, CO.
- Reynolds, J. B. 1996. Electrofishing. Pages 83-120 in B. R. Murphy and D. W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.
- Van Deventer, J.S. and W.S. Platts. 1989. Microcomputer software system for generating population statistics from electrofishing data-User's guide for MicroFish 3.0. US Department of Agriculture, Forest Service. Intermountain Research Station, General Technical Report INT-254.

**Table AQ2-1. Fish Population River Sampling Reaches.**

Study Reach	Bypass Reaches	Peaking Reach	Reaches Upstream of Project Facilities	Number of Fish Population Sampling Reaches
<b>Duncan Creek</b>				
Duncan Creek upstream of Diversion			●	1
Duncan Creek from Diversion to confluence with Middle Fork American River	●			1
<b>Middle Fork American River</b>				
Middle Fork American River upstream of French Meadows Reservoir			●	1
Middle Fork American River from French Meadows to confluence with Duncan Creek	●			1
Middle Fork American River from confluence with Duncan Creek to Middle Fork Interbay	●			1
Middle Fork American River from Middle Fork Interbay to Ralston Afterbay	●			1
<b>Ralston Afterbay Downstream</b>				
Middle Fork American River from Ralston Afterbay to confluence with Canyon Creek		●		1
Middle Fork American River from confluence of Canyon Creek to confluence with North Fork American River		●		1
<b>Rubicon River</b>				
Rubicon River upstream of Hell Hole Reservoir			●	1
Rubicon River from Hell Hole Reservoir to confluence with South Fork Rubicon River	●			1
Rubicon River from confluence with South Fork Rubicon River to Ralston Afterbay	●			2
<b>Long Canyon Creek</b>				
North Fork Long Canyon Creek upstream of Diversion			●	1
North Fork Long Canyon Creek from Diversion to confluence with Long Canyon Creek	●			1
South Fork Long Canyon Creek upstream of Diversion			●	1
South Fork Long Canyon Creek from Diversion to confluence with Long Canyon Creek	●			1
Long Canyon Creek from North and South Fork Long Canyon creeks confluence to confluence with Rubicon River	●			1
<b>North Fork American River</b>				
North Fork American River below the confluence with the Middle Fork American River		●		1

**Table AQ2-2. Reservoir and Diversion Pool Sampling Locations.**

Study Reservoir or Diversion Pool	Number of Sampling periods	Number of Fish Population Sampling locations
<b>Duncan Creek</b> Duncan Creek Diversion Pool	1	1
<b>Middle Fork American River</b> French Meadows Reservoir Interbay Reservoir	1 1	3 <sup>1</sup> 3 <sup>1</sup>
<b>Ralston Afterbay Downstream</b> Ralston Afterbay Reservoir	2	3 <sup>1</sup>
<b>Rubicon River</b> Hell Hole Reservoir	1	3 <sup>1</sup>
<b>Long Canyon Creek</b> North Fork Long Canyon Diversion Pool South Fork Long Canyon Diversion Pool	1 1	1 1

<sup>1</sup>Refers to the number of gillnetting locations in the reservoir.

**Placeholder for Figure AQ2-1**

**Fish Population Study Reaches**

**Non-Internet Public Information**

This Figure has been removed in accordance with the Commission regulations at 18 CFR Section 388.112.

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