FISH MONITORING PLAN

BIG CREEK HYDROELECTRIC SYSTEM

MAMMOTH POOL (FERC Project No. 2085)
BIG CREEK NOS. 1 AND 2 (FERC Project No. 2175)
BIG CREEK 2A, 8, AND EASTWOOD (FERC Project No. 67)
BIG CREEK NO. 3 (FERC Project No. 120)

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SUBMITTED BY
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1.0 GOALS AND OBJECTIVES

Monitoring fish populations provides a means of assessing the effects of the newly required minimum streamflow releases on fish community composition and abundance. The goal of the Fish Monitoring Plan is to evaluate the status of fish populations in selected reaches under the flow regimes stipulated by the new license. The specific objectives of the monitoring include the following items.

1) Monitor fish species composition and relative abundance in selected reaches and major reservoirs

2) Monitor size/age distribution of fish species

3) Monitor condition factor of sampled fish species

2.0 GENERAL APPROACH

The principal task of this plan is for SCE to collect data to characterize fish populations in the selected bypass reaches and major reservoirs. Fish species composition and relative abundance will be monitored using the same sampling methods and a subset of locations previously established during the relicensing surveys (SCE 2003). Species size/age distributions and condition factors will be monitored through a combination of electrofishing and snorkeling. Physical measurements and observations of stream conditions also will be made at each sampling site.

Fish surveys in a subset of the reaches including San Joaquin River from Mammoth Pool to Mammoth Pool Powerhouse, San Joaquin River Dam 6 to Powerhouse 3, and Mono Creek will begin in the third full year of the new license, followed by sampling of the set of study reaches listed in Table 1 in years 8, 18, 28, and 38, depending on the length of the license through the remainder of the license period, but not to begin before new minimum instream flows (MIFs) are implemented in each survey reach. If sampling is scheduled for a Wet Water Year, it will be postponed until the next non-Wet Water Year to avoid the potential confounding effect of high flows on fish recruitment and populations. Mammoth Pool Reservoir, Huntington Lake, Florence Lake, and Shaver Lake also will be sampled (Table 2). These reservoirs will be sampled for fish in the same years as sampling of the Big Creek ALP bypass reaches (years 8, 18, 28, and 38)[1] required by the Plan. As part of the reservoir sampling, tissue analyses for silver will be conducted in Mammoth Pool Reservoir and Huntington Lake. If not restricted by the license conditions for the other Big Creek System (BCS) hydroelectric projects, the sampling of other SCE operated reservoirs within the BCS, if required by those other licenses, will be performed consistent and concurrently with this Plan. When scheduling sampling site selection or field data collections, Southern California Edison Company (SCE) will give interested governmental agencies 30-days advance notice to provide

[1] If bypass reach fish sampling is postponed due to a wet water year or other reason, reservoir sampling will be postponed to remain concurrent with bypass reach sampling.

them with the opportunity to participate or observe. If field conditions or operational situations preclude a 30-day notification, SCE will provide notice as far in advance as feasible.

Draft reports will be provided by SCE to the Fisheries Review and Oversight Group (FROG) and other interested parties requesting the report following each monitoring period. The FROG will consist of the California Department of Fish and Game (CDFG); US Fish and Wildlife Service (USFWS); State Water Board; and United States Department of Agriculture-Forest Service (USDA-FS).

Table 1. Proposed Fish Population Monitoring Bypass Reaches.

Mammoth Pool (FERC Project No. 2085)
San Joaquin River – downstream of Mammoth Pool Dam
Big Creek Nos. 1 and 2 (FERC Project No. 2175)
Big Creek - Dam 4 to Powerhouse 2 and 2A
Big Creek 2A, 8, and Eastwood (FERC Project No. 67)
South Fork San Joaquin River below Florence Dam
Mono Creek below Mono diversion
Bear Creek below diversion
North Fork Stevenson Creek
Big Creek – Dam 5 to confluence with San Joaquin River
Big Creek No. 3 (FERC Project No. 120)
San Joaquin River – Dam 6 to upstream of Redinger Lake
Stevenson Creek below Shaver Lake

Table 2. Proposed Fish Population Monitoring Major Reservoirs.

Mammoth Pool (FERC Project No. 2085)
Mammoth Pool Reservoir
Big Creek Nos. 1 and 2 (FERC Project No. 2175)
Huntington Lake
Big Creek 2A, 8, and Eastwood (FERC Project No. 67)
Florence Lake
Shaver Lake

3.0 SAMPLING METHODS

3.1 ELECTROFISHING SAMPLING

Stream electrofishing will be conducted using backpack electrofishing units. This method will be used in habitats sufficiently shallow (under existing seasonal conditions

at the time of sampling) to allow effective sampling. Prior to initial sampling activities, specific habitat units will be visually inspected to determine if any special status amphibians are present. Sampling gear will be sterilized prior to use on a stream to avoid transport of pathogens.

Where conditions permit, sampling will be conducted using multiple-pass depletion. Population estimates from these data will be based on the maximum likelihood technique of Zippin (1958) or another scientifically accepted methodology.

The upstream and downstream ends of the site will be blocked using 0.25-inch mesh block nets. The block nets will prevent fish passage into or out of the site during sampling. At most sites, electrofishing will be conducted using one backpack electrofishing unit. At sites where the stream widths are approximately 20 feet or more, two backpack electrofishing units will be used. Sampling will be performed in an upstream direction beginning at the downstream block net and finishing at the upstream block net. Settings on the electroshocker will be adjusted to provide adequate strength for polarization and anesthesia of fish based on site-specific conditions, but low enough to prevent excessive harm to shocked fish. A typical electrofishing team will consist of one backpack electrofisher, one or two net persons, and one net/livecar person for streams smaller than 20 feet wide. Additional backpack electrofishers and net persons will be required for streams greater than 20 feet wide. Electrofishing will be generally conducted as described by Reynolds (1996).

Fish captured from each pass will be transferred to separate holding pens outside of the sample site. Between passes, the fish captured during that pass will be processed as described in the Section 3.3, Fish Processing.

3.2 SNORKEL SURVEYS

Snorkel surveys will be conducted in habitat units that are too deep to be effectively sampled using electrofishing techniques (i.e., pool habitats). The habitat units will be divided into one or more swimming lanes parallel to the direction of stream flow, depending upon stream width and visibility. Underwater visibility will be measured to determine lane width (Hillman et al. 1992). If stream velocity or depth impedes the diver's ability to move upstream, pull ropes will be used to assist the diver. A main rope will be positioned at the uppermost boundary of the sample site, perpendicular to the flow. Pull ropes (one for each diver) will be evenly spaced and attached to the main rope. The pull ropes extend to the lower most boundary of the sample site and will be allowed to float at the water surface parallel with the stream flow. Lane markers and pull ropes, if used, will be positioned in the site at least two hours prior to each direct underwater observation survey. This delay minimizes the influence of disturbance on the fish community (Hankin and Reeves 1988). Methods will be generally similar to those presented in Griffith (1972), Platts et al. (1983), Hicks and Watson (1985), Hankin and Reeves (1988), and Hillman et al. (1992). Surveys will be performed between 0900 to 1600 hours (Hankin and Reeves 1988) so that light intensity will be suitable for observing fish. Direct observation surveys will not be conducted on overcast days (Platts et al. 1983).

Divers will enter the water slightly below the downstream end of the sample unit (Hankin and Reeves 1988) and move directly across and slightly below the lowermost boundary of the sample unit into their designated swimming lane. When in position, the divers will move upstream to the lowermost boundary of the sample unit. From a fixed position and prior to moving upstream, the divers will look upstream to locate fish on the limits of visibility (Platts et al. 1983). Divers will then identify and count fish species in their lane while moving slowly upstream at a uniform, even pace with no abrupt movements. Fish will be counted as they pass below or to the side of an observer. Cover for fish, such as interstitial spaces between substrate particles, wood debris, bubble screens, crannies in bedrock and along stream margins, will be inspected closely for concealed fish to the best of the divers' abilities (Fausch and White 1981; Hicks and Watson 1985). A bank-side observer will be stationed to monitor and verbally direct diver distribution and sampling rate.

Fish lengths will be estimated by comparison with a fish length calibration cord. The calibration cord is a piece of small diameter rope with size-length categories marked on it. In addition to the fish length calibration cord, all divers will be trained in estimating fish lengths, so estimates of fish length will be consistent and accurate.

Night snorkeling will be minimally included in fish monitoring at established sampling sites in the San Joaquin River between Mammoth Pool Dam and Mammoth Pool Powerhouse. Night snorkeling will be used to assist in detecting the presence of larger and older brown trout in pools, whose cryptic behavior may result in under-representation in daylight snorkel sampling. Sampling will occur prior to implementation of the new MIFs or during the first year of implementation to assess this segment of the brown trout population. This sampling will be repeated during year 8, after implementation of the new MIFs in this reach, to evaluate changes that may have occurred in this population segment under the new MIFs.

3.3 RESERVOIR SAMPLING METHODS

Sampling will take place using sampling approaches consistent with the same methods and locations previously established during the relicensing surveys (SCE 2003). Reservoirs will be sampled for fish through a variety of techniques, including electrofishing, minnow traps and trap nets in shallow areas, gill and trap nets in deeper areas, and hydroacoustic surveys in all areas. Hydroacoustic density surveys will be used to characterize overall fish density.

Electrofishing will be conducted using a boat or barge shocker. During this sampling, representative coves and shallow margin habitats will be sampled. Fish will be stunned and netted from the boat. All fish captured will be processed as described in the Fish Monitoring Plan.

Minnow traps and trap nets will be set in shallow water and baited with sardines. These traps will be set for 48 hours and checked at approximately 12-hour intervals. All fish captured will be processed as described above.

Variable mesh (¼ to 2 inches mesh) gill nets will be set overnight for 2 nights and checked in the morning. All fish captured will be processed as described above.

Crayfish will be collected for tissue sampling in Mammoth Pool Reservoir using baited inclined plane traps used for characterizing crayfish populations as part of the ALP studies.

Hydroacoustic surveys will be conducted to characterize reservoir fish populations in large reservoirs. The surveys will be conducted using boat mounted hydroacoustic equipment. A BioSonics Model DT4000 digital echosounder or equivalent will be used with the transducer mounted on a sled designed to be towed behind the boat. Data will be collected; including GPS coordinates of sampling transects, to allow spatial integration of fish counts to determine fish densities. The transducer will be towed through the lake in a series of about 10 transects or their equivalent, depending upon the size of the lake, to provide sufficient coverage of the lake to obtain a reasonable estimate the number of fish present. Due to the configuration of the hydroacoustic equipment, this method will be employed primarily in areas where water depth exceeds 10 feet. At depths less than 10 ft, the volume of the cone ensonified by the hydroacoustic transducer is too small to provide adequate sampling results.

3.4 SILVER SAMPLING

As part of reservoir sampling, fish and crayfish will be collected from Mammoth Pool Reservoir and fish from Huntington Lake for tissue analysis to evaluate for the presence bioaccumulated silver. Ten wild fish would be collected from each reservoir, and an additional ten crayfish would be collected from Mammoth Pool reservoir, using the same collection technique used in support of the ALP studies. Samples would be analyzed for silver content in 1) fish muscle tissue; 2) fish liver; and 3) entire crayfish. Tissue samples will be analyzed by a state-certified laboratory. The analysis method used will be selected in consultation with the FROG and CalEPA.

3.5 FISH PROCESSING

All fish captured through electrofishing will be identified to species, measured for length to the nearest millimeter fork length for species with forked tails (i.e., trout species) or total length for all other species, and weighed to the nearest 0.1 g for fish up to two kg, or to the nearest one g for fish over two kg. If large numbers (>100) of a species are captured, each fish will be counted and identified, but the measurements will be collected from a sub-sample of fish. The sub-samples will be stratified by size class, with 10 measurements collected within each 25-mm size category.

Scale samples will be collected from wild trout for age determination. Scales will be collected from the back of the fish above the lateral line and below and slightly behind the dorsal fin. Scales will be stored in envelopes and the date, stream, site, species, length, weight and a data sheet reference code will be recorded on the envelope. Scale samples are available to the FROG upon request.

Scale analysis will be conducted to determine the age of sampled trout and to assess the age structure of sampled populations. In order to determine the age of the fish, scales will be mounted on standard glass microscope slides and either directly viewed through a microscope or imaged with a microscope-mounted digital camera. Images of scales will be digitally recorded for analysis. The electronic files will allow biologists to view and manipulate the scale images using simple imaging software (e.g., Motic® Images 2000 release 1.2, Jasc® Paintshop Pro version 7.02, or equivalent). The digital images of the scales will be manipulated to make the annuli appear distinct from the rest of the circuli (scale rings). Due to their small size and the limitations of digital imaging, brook trout scales will not be amenable to digital recording. The brook trout scales will be aged using a microscope or standard microfiche viewer.

3.6 PHYSICAL CONDITIONS

Routine observations will be made of habitat and physical conditions in the specific bypass reach areas sampled. These observations will include physical measurements of water temperature, specific conductance, and dissolved oxygen. Physical measurements also will be taken of reservoir conditions. These will include measurements of water temperature, specific conductance, and dissolved oxygen. These measurements will be profiled at two locations in each reservoir, in locations similar to those used during the ALP field studies. Measurements will be made using either a Hydrolab Quanta or equivalent water quality meter. Water quality meters will be calibrated at least daily prior to use, to correct for altitude and dissolved oxygen saturation among sites.

4.0 FISH POPULATION CHARACTERISTICS

Hatchery-origin and wild trout will be evaluated separately and hatchery trout will not be included in population characteristics calculated for wild trout. Characteristics that are used to differentiate hatchery trout from wild trout will be identified.

Fish populations will be characterized by abundance, biomass, and density. Abundance will be characterized as numbers sampled per site by species and lifestage. Biomass will be characterized by biomass per species and lifestage at each site. Density will be reported as numbers and biomass per kilometer and hectare. Density will be provided by species and lifestage.

Condition factors will be calculated for trout, hardhead, pike minnow, and other species as appropriate and directed by the FROG. Condition factors will be calculated by species and lifestage and reported as both the mean and 95% confidence limits, if adequate numbers of species and lifestages are collected to make these measurements meaningful.

Population structure will be reported based on scale aging and length frequency results. Length frequency histograms will be provided for target fish species. Length at age will be assessed and reported.

The presence of disease, parasites, or injury to fish will be summarized and reported.

5.0 FISH MONITORING SITES

Fish monitoring will occur during August and September in listed reaches along medium and large diversions that were surveyed in 2002, as part of the current licensing process. Those surveys were conducted by electroshocking, supplemented by snorkeling at several sites. The snorkeling and electrofishing provided complementary results, which were reported in the license application.

The study area is summarized as the following Project-affected reaches of the Big Creek system (Table 1 provides breakdown by Project reach):

1) South Fork San Joaquin River
2) Bear Creek
3) Mono Creek
4) San Joaquin River (Mammoth Reach)
5) San Joaquin River (Stevenson Reach)
6) Big Creek (below Dam 4)
7) Big Creek (below Dam 5)
8) Stevenson Creek
9) North Fork Stevenson Creek

Table 2 provides a list of the major Project reservoirs that will by sampled by Project. These reservoirs are:

1) Mammoth pool Reservoir
2) Huntington Lake
3) Florence Lake
4) Shaver Lake

6.0 REPORTING

6.1 DRAFT REPORT

A Draft Technical Report providing the results of the fish population survey will be prepared by SCE within 120 days following completion of the fieldwork following each monitoring period and provided to the FROG, and other parties requesting copies of the report. The report will follow the general presentation layout for basic fish monitoring data used in the CAWG 7, Characterize Fish Population Technical Study Report (SCE

2003). The report will include a map showing the locations of the monitoring stations. The report will provide tabular results for numbers captured and average length and weight for each species at each station. The table will also provide computed abundance, total length, length/weight ratios, average condition factors, and biomass estimates, with 95 percent confidence limits for each species and lifestage captured in sufficient quantities. The report also will provide a graph of the combined length-frequency distribution from all monitoring stations. In addition to describing the results, the report will compare the results with previous fish population surveys (starting with 2002 sampling), from each monitoring site and will discuss implications regarding trends in fish abundances. Results of hydroacoustic surveys will be compared with fish netting results for each of the reservoirs sampled. Fish densities will be described for depth intervals corresponding to those evaluated for reservoir habitat. Netting will be used to characterize differences in habitat use for different species and lifestages, identify species composition, and catch per unit effort by species and lifestage.

Results of reservoir tissue sampling for silver will be included in the report and will be compared to appropriate criteria. Also included in the report shall be any water temperature monitoring data or physical measurements that have been collected concurrently for the year during the fish population surveys.

A 60-day review period for the FROG will be provided. Based on the results of the fish population monitoring and comments received during the review process, SCE may elect to meet with the FROG to discuss any outstanding issues. Within 30 days following the receipt of comments, or 30 days following a meeting, comments will be addressed and the final progress report will be filed with the FROG and the Federal Energy Regulatory Commission (Commission or FERC).

6.2 FINAL SUMMARY REPORT

A Draft Final Technical Report summarizing the fish monitoring would be prepared by SCE and provided to the FROG and other interested parties within 120 days following the completion of the last sampling period (year 8, 18, 28, and 38 depending on period of license). The report will follow the general presentation layout for basic fish monitoring data used in the CAWG 7 Fish Population Study Report (SCE 2003). The report will provide results as detailed in the previous section.

A 60-day review period for the FROG will be provided. Based on the results of the fish population monitoring and comments received during the review process, SCE may elect to meet with the FROG to discuss any outstanding issues. Within 30 days following the receipt of comments, or 30 days following a meeting, comments will be addressed and the final progress report will be filed by SCE with the FROG and the FERC. These data should be used in any relicensing process that is being used by FERC at the time of the expiration of this license.

7.0 LITERATURE CITED

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