UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
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Long Beach, California 90802-4213

January 26, 2012

MEMORANDUM FOR: Permit 16608 (151422 SWR2012SA00015) file

FROM: Rodney R. McInnis
Regional Administrator

SUBJECT: Documentation of Endangered Species Act section 7 consultation (PCTS TN# 2012/00052) for the issuance of section 10(a)(1)(A) scientific research Permit 16608 authorizing take of California Central Valley steelhead (*Oncorhynchus mykiss*)

I. INTRODUCTION

Section 10(a)(1)(A) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1536 *et seq.*), provides NOAA's National Marine Fisheries Service (NMFS) with the authority to grant scientific research exemptions to the ESA's section 9 "taking" prohibitions (see regulations at 50 CFR § 222.301 through 222.308, and 50 CFR § 224.101 through 224.102). Section 10(a)(1)(A) scientific research or enhancement permits may be issued to Federal or non-Federal entities conducting research or enhancement activities that involve intentional take or ESA-listed species. Any permitted research or enhancement activities must: (1) be applied for in good faith; (2) if granted and exercised, not operate to the disadvantage of the threatened or endangered species; and (3) be consistent with the purposes and policy set forth in section 2 of the ESA [50 CFR § 222.303(f)]. When granting such permits, NMFS must consult internally under section 7 of the ESA to ensure that permits do not appreciably reduce the likelihood of survival and recovery of ESA-listed species. In compliance with section 7(a)(2) of the ESA, in this biological opinion (BO), NMFS analyzed the effects of the issuance of Permit 16608, authorizing take of ESA-listed species from the San Joaquin River (SJR), California Central Valley (CCV) steelhead distinct population segment (DPS).

II. CONSULTATION AND PERMIT HISTORY

The US Bureau of Reclamation (Reclamation) proposes to conduct research and monitoring activities under a section 10 permit beginning December 1, 2011, through March 31, 2014. The non-lethal take of threatened CCV steelhead is anticipated to occur during activities proposed for permitting. On November 17, 2011, NMFS received Reclamation's application for a research permit pursuant to section 10(a)(1)(A) of the ESA. Reclamation requested ESA coverage for take of CCV steelhead associated with research monitoring activities taking place in steelhead habitat in the SJR. On December 13, 2011, NMFS published a notice of receipt in the Federal Register outlining the research activities and take of ESA-listed species proposed under Permit 16608 (76 FR 77490). The public comment period for Permit 16608 closed January 12, 2012. No comments we received from the public.

III. DESCRIPTION OF THE PROPOSED ACTION

NMFS Southwest Region, Protected Resources Division proposes to issue scientific research Permit 16608 under the authority of section 10(a)(1)(A) of the ESA. Permit 16608 is for scientific and research activities to be conducted in the SJR from the date of permit issuance through March 31, 2014. Permit 16608 would be subject to the limitations of the ESA and the regulations in 50 CFR 222, 223, and 224, unless it is modified, suspended, or revoked. The permit will authorize Reclamation for non-lethal and unintentional lethal take of CCV steelhead during monitoring activities in the mainstem SJR, and at entrances to bypasses and false migration pathways, between the base of Sack Dam (river mile 182, near Dos Palos, California) and the confluence of the Merced River. The take activities authorized under Permit 16608 will include: capture (boat electrofishing, fyke nets with wing walls and fish traps, and steelhead-specific trammel nets), and handling (measured, sexed, sampled for scales and tissue, and checked for injuries and presence of tags) of captured/stunned CCV steelhead. Captured fish will be Floy tagged with a unique identification number to document any recaptures that may occur in the study area. Captured CCV steelhead will be transported and released in the SJR downstream of the mouth of the Merced River.

A. Project Description

The Steelhead Monitoring Plan is conducted under the auspices of the San Joaquin River Restoration Program (SJRRP). Spring interim flows from February 1 to June 1 could attract adult steelhead into the Restoration Area, the San Joaquin River (SJR) above the confluence of the Merced River and below Friant Dam prior to the completion of SJRRP habitat improvements and measures to obscure false migratory pathways. The Steelhead Monitoring Plan will monitor for the presence of CCV steelhead on the SJR upstream of the Merced River confluence. In addition, the Steelhead Monitoring Plan proposes to rescue CCV steelhead that would not have access to suitable spawning habitat further upstream on the SJR due to the presence of numerous passage impediments. Captured individuals will be transported and released at the mouth of the Merced River where suitable habitat is accessible.

<u>Background</u>

In 1988, a coalition of environmental groups, led by the Natural Resources Defense Council (NRDC), filed a lawsuit challenging the renewal of long-term water service contracts between the United States and the Central Valley Project Friant Division Long-Term Contractors. After more than 18 years of litigation of this lawsuit, known as *NRDC, et al. v Kirk Rogers, et al.* a Settlement was reached. On September 13, 2006, the Settling Parties, including NRDC, Friant Water Users Authority, and the U.S. Departments of the Interior and Commerce, agreed on the terms and conditions of the Settlement, which was subsequently approved by the U.S. Eastern

District Court of California on October 23, 2006. The Settlement establishes two primary goals: (1) Restoration Goal – To restore and maintain fish populations in "good condition" in the mainstem San Joaquin River below Friant Dam to the confluence of the Merced River, including naturally reproducing and self-sustaining populations of salmon and other fish, and (2) Water Management Goal – To reduce or avoid adverse water supply impacts on all of the Friant Division long-term contractors that may result from the Interim and Restoration Flows provided for in the Settlement.

Methodology

Sampling Method 1: Raft Mounted Electroshocker

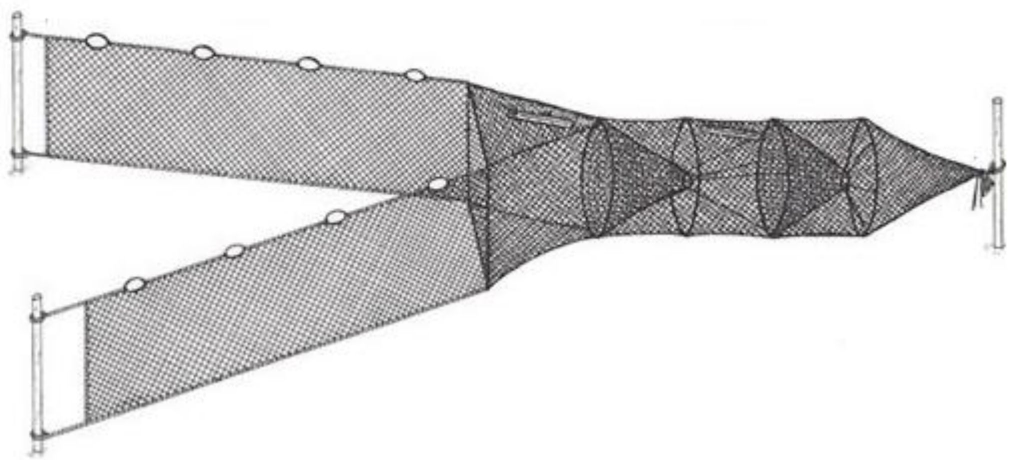
Sampling frequency will be once monthly from December through March of each sampling year. Re-capture is to be anticipated, thus monthly sampling is important to ensure fish recovery from stress between capture. Raft mounted electroshockers will be used in order to navigate through shallow waters of the sampling locations all within the mainstem SJR (*i.e.*, just upstream of the confluence of the SJR and Merced River, the mouth of Mud Slough, the SJR near the Highway 140 bridge, the mouth of Salt Slough, just below Sack Dam, and at the return points of the Eastside and Mariposa bypasses)). Electrofishing methods for this study refer to the NMFS guidelines for sampling waters with anadromous fish. NMFS guidelines are for backpack electrofishing; however, researchers are not precluded for using other techniques or equipment as long as NMFS is given substantial proof that proposed techniques or equipment are necessary for the study and that listed species are safeguarded. A backpack electroshocker is not a feasible method for monitoring the deeper canals of some false pathways, and will not be used due to the large size of the sampling area. The raft-mounted electroshocker will have access to both deep and shallow water habitats, and will use the same guidelines for initial and maximum settings as for backpack electroshocking. The model of raft electroshocker is a Cataraft SR-17 Electroshocker, equipped with a Generator 5 generator powered pulsator (gpp), control box 5.0 gpp, 3-chamber Dupont Hypalon pontoons, electrofisher booms, electrode arrays, built-in foot switches, cathode array, hand-operated air pump, and an Evinrude E25DTL engine.

Sampling Method 2: Fyke Nets with Wing Walls and Fish Traps

A fyke net with wing walls (see Figure 1) tends to be the most useful in capturing fish that follow the shorelines at different times of the day during the migration season. These nets are constructed of 3.7-centimeter (cm) mesh formed over a 1.5 meter (m) x 0.5 m rectangular lead hoop with 0.95 cm diameter solid round stock and three 1.5-m diameter hoops. The traps contain two 5-m long throats with 15 or 25 cm diameter throats, and have a zipper for easy fish removal. Wings will be 1.8-m deep and 48.8-m long. A buoy will be affixed with a 10-m length of rope. Nets will be in place with 22-kilogram (kg) anchors and will be concurrently deployed in the mainstem SJR sampling locations (*i.e.*, just upstream of the confluence of the SJR and Merced River, the mouth of Mud Slough, the SJR near the Highway 140 bridge, the mouth of Salt Slough, just below Sack Dam, and at the return points of the Eastside and Mariposa bypasses). The traps will be checked at least once and up to twice daily. The fyke net in this study is specifically designed to minimize effects on steelhead as the 2.54-cm mesh is small enough to prevent gilling of adults, the netting is knotless to avoid abrasion, and they are a very fine and soft (softer than nylon) multi-fiber polyester to prevent scale loss (Donald E. Portz, Bureau of Reclamation, Technical Services Center, personal communication, 2012).

This proposed technique will be implemented once the Hills Ferry Barrier (HFB) is removed around mid-December and will remain deployed until March 15. The traps will be checked daily, so the likelihood of fish being physically injured is low. CCV steelhead that are captured will be sampled, tagged, and released in the SJR at the mouth of the Merced River where suitable habitat is accessible. Data from this trap will give an index of steelhead abundance migrating in the San Joaquin River upstream of the confluence of the Merced River.

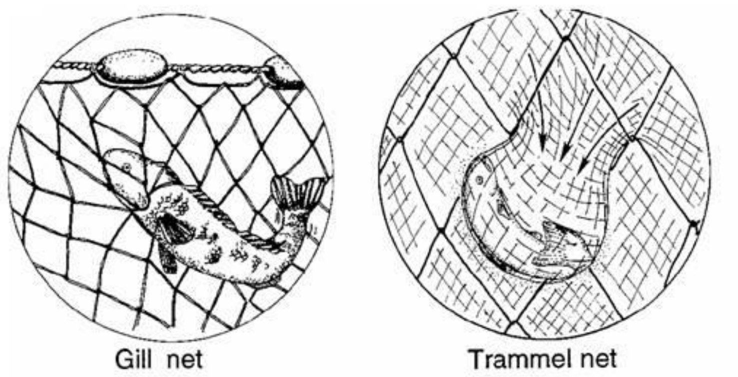
Figure 1. Example illustration of a fyke net with wing walls (image from www.fipec.qc.ca)



Sampling Method 3: Steelhead-Specific Trammel Nets

Trammel nets are most commonly used as stationary gear to block off channels with low velocities or no flows. However, they can also be used to drift in short durations (*i.e.*, up to 10 minutes) on high velocity water, which is what this study proposes. A short duration drifting of a trammel net is necessary to minimize the time captured fish are entangled. Only one trammel net will be drifted at a time, at the same locations in the mainstem SJR as sampling methods 1 and 2. The trammel net used for this study is specifically designed for steelhead by integrating the following: 1) it is knotless to reduce abrasiveness; (2) it is a very fine and soft (softer than nylon) multi-fiber polyester to reduce loss of scales; and (3) the 2.54-cm diameter mesh is used in order to prevent gilling of adults. It includes three parallel vertical layers of netting. The inner net has a very small mesh size, while the outer nets have mesh size large enough for fish to pass. The larger and smaller mesh size nets form a pocket when fish attempt to swim through. Similar to seine nets, trammel nets are equipped with floats attached to the head rope and lead weights along the ground rope. For safety reasons, brightly colored floats will be used to attach to the head rope so boaters and other recreationists can avoid entangling themselves, their boats, and/or their fishing gear with the nets. To ensure safety of CCV steelhead, fisheries biologists follow at a close distance to observe and retrieve nets in short time intervals. Sampling time will depend on the number of fish and bycatch caught at each location; however, the duration of drifting the trammel net will not exceed 10 minutes per deployment.

Figure 2. Example illustration (Hubert 1996) showing a comparison between a gill net and trammel net



For all the sampling methods listed above, captured CCV steelhead will be subject to standard handling and transport procedures. This includes the following: (1) there will be two aerated coolers (125 liters) present either on the raft or at the capture location, filled with water from the sample site and kept within +/- 1° Celsius (C) of the sample site location; (2) one cooler will specifically hold captured CCV steelhead; the other will hold all other non-listed species; (3) the dips nets used are designed to be non-abrasive, soft and knotless with 5-millimeter holes, specifically for CCV steelhead; (4) if a CCV steelhead is captured, the fork and total lengths will be measured, pictured, sexed if possible, and visually observed for health, sampled for scales and tissues, and presence of tags (Note: fish will not be weighed or anesthetized.); (5) fish will be Floy tagged with a unique identification number to document any recaptures that may occur in the study area; (6) upon capture and data collection of CCV steelhead, the crew will discontinue sampling and place fish in the tanks described in step (1) above, as it may take up to one hour to travel to the transportation tanks depending on the sampling location. Fish will not be weighed or anesthetized to reduce handling time and minimize stress. With regard to water quality, water temperature in short-term holding tanks will be similar to the originating source to avoid thermal shock when fish are being transported to a more suitable habitat. The temperature range will be buffered to $\pm 1.0^{o}$C. Ice will be added if water temperature increases during the short-term transport. Ice added to water in the holding tank may contain chlorine (Cl_2) that may interfere with the physiological functions of steelhead. In order to keep chlorine levels below the safe holding concentration of 0.003 mg/L, an appropriate amount of AmQuel® Plus will be added for detoxification. Also during transport, ammonia (NH_3-N un-ionized) will be kept below 0.0125 mg/L and ammonia (NH_3-N Total) below 1.0 mg/L by preventing high load densities. However, AmQuel® Plus will also aid in detoxifying both un-ionized and total ammonia.

Captured steelhead will be transported downstream to the confluence of the San Joaquin and Merced rivers in transport tanks. Transport protocol will include the procedures listed below. The transport tanks will be immediately filled with river water prior to transport using a portable screened pump. Captured CCV steelhead will be moved in and out of the transport truck using a water-filled vessel to help minimize stress and loss of their protective slime layer. Oxygen gas will be supplied to the transport tanks using compressed oxygen gas cylinders and micro-bubble diffusers to maintain dissolved oxygen levels at near saturation during transportation. Transport water will be supplied with sodium chloride to 6-parts per thousand to minimize physiological stress during transportation. The truck will be stopped after 30 minutes of transportation and each hour thereafter for visual inspection of the life-support system and fish. Water will be tempered to the receiving water at the predetermined release location before transferring fish by pumping receiving water directly into the transport tank until the temperature reaches that of the release water.

B. Description of the Action Area

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 404.2). For the purposes of this BO, the action area is defined as the San Joaquin River between the base of Sack Dam and just below the confluence of the Merced River, including select locations on the Mariposa and Eastside bypasses, and the entrances to the following off-channel sloughs: Mud Slough, Salt Slough, and Newman Wasteway. Sack Dam will be the upstream extent because it is impassable in low water year types.

C. Requested Amount of Take and Unintentional Mortality

The estimated amount of non-lethal and unintentional lethal take proposed is based on the low number of CCV steelhead individuals observed in the San Joaquin watershed upstream of the confluence of the Merced River during California Department Fish and Game (CDFG) monitoring efforts at the HFB. More details regarding this monitoring is described below in the Environmental Baseline section.

<u>Estimate of Take</u>

Table 1. Estimated annual take of CCV steelhead associated with the Permit 16608 monitoring survey activities.

Life Stage/ *O. mykiss*	Listing Unit/Stock	Origin	Sex	Expected Take	Indirect Mortality	Take Action	Observation/ Collect Method	Sampling Period
Unknown	California Central Valley (NMFS Threatened)	Natural	Male and Female	6	0	Capture/Mark, Tag, Sample Tissue/ Release Live Animal	Net, Fyke	1/19/2012 thru 3/31/2014
Unknown	California Central Valley (NMFS Threatened)	Natural	Male and Female	10	1	Capture/Mark, Tag, Sample Tissue/ Release Live Animal	Electrofishing, Raft	1/19/2012 thru 3/31/2014
Unknown	California Central Valley (NMFS Threatened)	Natural	Male and Female	2	0	Capture/Mark, Tag, Sample Tissue/ Release Live Animal	Net, Trammel	1/19/2012 thru 3/31/2014

IV. DESCRIPTION AND STATUS OF THE SPECIES AND CRITICAL HABITAT

A. Species and Critical Habitat Listing Status

CCV steelhead were originally listed as threatened on March 19, 1998 (63 FR 13347). Following a new status review (Good *et al.* 2005) and after application of the agency's hatchery listing policy, NMFS reaffirmed its status as threatened and also listed several hatchery stocks as part of the DPS in 2006 (71 FR 834). In June 2004, after a complete status review of 27 west coast salmonid evolutionarily significant units (ESUs) and DPSs, NMFS proposed that CCV steelhead remain listed as threatened (69 FR 33102). On January 5, 2006, NMFS reaffirmed the threatened status of the CCV steelhead and applied the DPS policy to the species because the resident and anadromous life forms of *O. mykiss* remain "markedly separated" as a consequence of physical, ecological and behavioral factors, and therefore warranted delineation as a separate DPS (71 FR 834). On August 15, 2011, NMFS completed another 5-year status review of CCV steelhead and recommended that the CCV steelhead DPS remain classified as a threatened species (NMFS 2011).

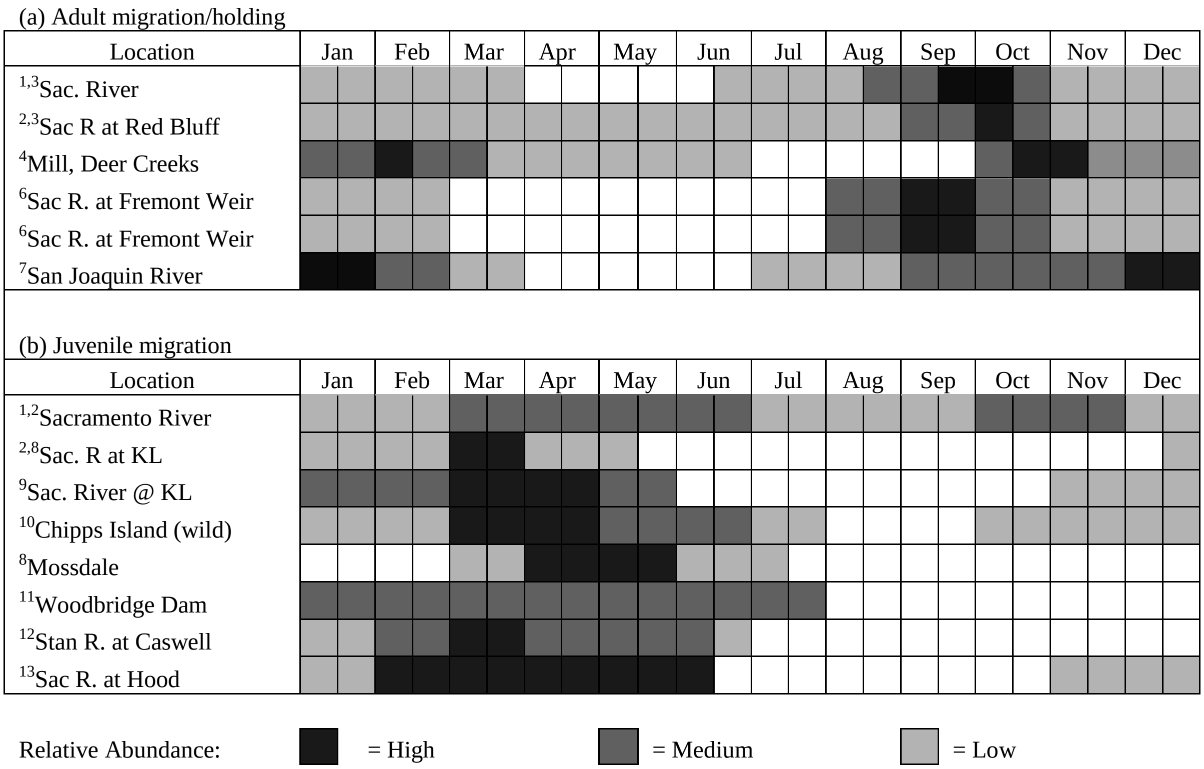
Critical habitat was designated for CCV steelhead on September 2, 2005 (70 FR 52488). Critical habitat includes the stream channels to the ordinary high water line within designated stream reaches such as those of the American, Feather, and Yuba rivers, and Deer, Mill, Battle, Antelope, and Clear creeks in the Sacramento River basin; the Mokelumne, Calaveras, Stanislaus, Tuolumne, and Merced rivers in the San Joaquin River basin; and, the Sacramento and San Joaquin rivers and Delta. Currently the CCV steelhead DPS and critical habitat extends up the SJR up to the confluence with the Merced River.

B. Steelhead Life History

CCV Steelhead can be divided into two life history types, summer-run steelhead and winter-run steelhead, based on their state of sexual maturity at the time of river entry and the duration of their spawning migration, stream-maturing and ocean-maturing. Only winter-run (ocean maturing) steelhead currently are found in California Central Valley rivers and streams (Moyle 2002; McEwan and Jackson 1996). Summer-run steelhead have been extirpated due to a lack of suitable holding and staging habitat, such as coldwater pools in the headwaters of CV streams, presently located above impassible dams (Lindley *et al.* 2006).

CCV steelhead remain in the ocean for up to four years before returning to their natal streams as adults to spawn (Shapovalov and Taft 1954). Adult steelhead size depends on the length of their ocean residency (Meehan and Bjornn 1991). Unlike Pacific salmon, steelhead do not appear to form schools in the ocean (Behnke 1992). Steelhead in the southern part of their range appear to migrate close to the continental shelf, while more northern populations may migrate throughout the northern Pacific Ocean (Barnhart 1991). CCV steelhead generally leave the ocean from August through April (Busby *et al.* 1996) and enter freshwater from August to November and spawn from December to April, with peaks from January through March, in small streams and tributaries where cool, well oxygenated water is available year-round (Table 1; Williams 2006; Hallock *et al.* 1961; McEwan and Jackson 1996). CCV steelhead hold in pools while maturing sexually, while others begin sexual maturation in the ocean and spawn within a few months after entering streams (Williams 2006). Timing of upstream migration is correlated with higher flow events, such as freshets or sand bar breaches, and associated lower water temperatures. The minimum stream depth necessary for successful upstream migration is 13 cm (Thompson 1972). Adults typically spend a few months in freshwater before spawning (Williams 2006). Female steelhead construct redds in suitable gravels, primarily in pool tailouts and heads of riffles. Steelhead generally return to freshwater at ages two and three and range in size from two to twelve pounds (Reynolds *et al.* 1993). The number of eggs laid per female depends on size and origin of the fish (Moyle 2002). Steelhead about 55 cm long may have fewer than 2000 eggs, whereas steelhead 85 cm long can have 5,000 to 10,000 eggs, depending on the stock (Meehan and Bjornn 1991).

Table 2. The temporal occurrence of adult (a) and juvenile (b) California Central Valley steelhead in the Central Valley. Darker shades indicate months of greatest relative abundance.



Sources: [1]Hallock 1961; [2]McEwan 2001; [3]USFWS unpublished data; [4]CDFG 1995; [5]Hallock *et al.* 1957; [6]Bailey 1954; [7]CDFG Steelhead Report Card Data 2007; [8]CDFG unpublished data; [9]Snider and Titus 2000; [10]Nobriga and Cadrett 2003; [11]Jones & Stokes Associates, Inc., 2002; [12]S.P. Cramer and Associates, Inc. 2000 and 2001; [13]Schaffter 1980, 1997.

Unlike Pacific salmon, steelhead are iteroparous, which are capable of spawning more than once before death (Busby *et al.* 1996). However, it is rare for steelhead to spawn more than twice before dying; most that do so are females (Busby *et al.* 1996). Iteroparity is more common among southern steelhead populations than northern populations (Busby *et al.* 1996). Although one-time spawners are the great majority, Shapolov and Taft (1954) reported that repeat spawners are relatively numerous (17.2 percent) in California streams. Hatchery steelhead are typically less likely than wild fish to survive to spawn a second time (Leider *et al.* 1986). Post-spawning steelhead may migrate downstream to the ocean immediately after spawning or may spend several weeks holding in pools before outmigrating (Shapovalov and Taft 1954). Steelhead eggs hatch in three to four weeks at 10°C to 15°C (Moyle 2002). The length of time it takes for eggs to hatch depends mostly on water temperature. After hatching, alevins remain in the gravel for an additional two to five weeks while absorbing their yolk sacs, and emerge in spring or early summer (Barnhart 1991). Fry emerge from the gravel usually about four to six weeks after hatching, but factors such as redd depth, gravel size, siltation, and temperature can speed or retard this time (Shapovalov and Taft 1954). Upon emergence, fry inhale air at the stream surface to fill their air bladders, absorb the remains of their yolks, and start to feed actively, often in schools (Barnhart 1991; NMFS 1996). Then the newly emerged fry move to the shallow, protected areas associated within the stream margin (McEwan and Jackson 1996) and they soon move to other areas of the stream and establish feeding locations, which they defend (Shapovalov and Taft 1954). Fry are typically less than 50 millimeters standard length (SL) (Moyle 2002). As fry increase in size and their swimming abilities improve during late summer and fall, they increasingly use areas with cover and exhibit a preference for higher velocity, deeper mid-channel areas near the thalweg (Hartman 1965; Everest and Chapman 1972; Fontaine 1988). Optimal water temperatures for growth range from 15°C to 18°C (Moyle 2002).

Juvenile steelhead (parr) rear in freshwater for one to three years before outmigrating to the ocean as smolts (Moyle 2002). The time that parr spend in freshwater appears to be related to growth rate, with larger, faster-growing members of a cohort smolting earlier (Peven *et al.* 1994). Juveniles occupy a wide range of habitats, preferring deep pools, as well as higher velocity rapid and cascade habitats (Bisson *et al.* 1982, 1988). During periods of low temperatures (< 44.6° Fahrenheit) and high flows associated with the winter months, juvenile steelhead seek refuge in interstitial spaces in cobble and boulder substrates (Bustard and Narver 1975; Everest *et al.* 1986). Juveniles' winter hiding behavior reduces their metabolism and food intake requirements and minimizes their exposure to predation and high flows (Bustard and Narver 1975). Steelhead rearing during the summer takes place primarily in higher velocity areas in pools, although young-of-year also are abundant in glides and riffles. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small woody debris. Cover is an important habitat component for juvenile steelhead both as velocity refugia and as a means of avoiding predation (Meehan and Bjornn 1991).

Steelhead smolts migrate downstream during most months of the year , but the peak period of emigration occurs in spring, with a much smaller peak in the fall (Hallock *et al.* 1961). Emigrating steelhead use the lower reaches of a river and the Delta for rearing and as a migration corridor to the ocean. Juvenile steelhead feed mostly on drifting aquatic organisms and terrestrial insects and will also take active bottom invertebrates (Moyle 2002). Some may utilize tidal marsh areas, non-tidal freshwater marshes, and other shallow water areas in the Delta as rearing areas for short periods prior to their final emigration to the sea. Hallock *et al.* (1961) found that juvenile steelhead migrate downstream during most months of the year, but the peak period of emigration occurred in the spring with a much smaller peak in the fall. Nobriga and Cadrett (2003) also have verified these temporal findings based on analysis of captures at Chipps Island, Suisun Bay.

C. Species Population Trends

Historic CCV steelhead run sizes are difficult to estimate given the paucity of data, but may have approached one to two million adults annually (McEwan 2001). By the early 1960s the steelhead run size had declined to about 40,000 adults (McEwan 2001). Hallock *et al.* (1961) estimated an average of 20,540 adult steelhead through the 1960s in the Sacramento River upstream of the Feather River. Steelhead counts at the Red Bluff Diversion Dam (RBDD) declined from an average of 11,187 for the period of 1967 to 1977, to an average of approximately 2,000 through the early 1990s, with an estimated total annual run size for the entire Sacramento-San Joaquin system, based on RBDD counts, to be no more than 10,000 adults (McEwan and Jackson 1996, McEwan 2001).

About 80 percent of habitat in the Central Valley that was historically available to steelhead is now behind impassible dams (Lindley *et al.* 2006). The extent of habitat loss for steelhead most likely was much higher than that for salmon because steelhead were undoubtedly more extensively distributed. Due to their superior jumping ability, the timing of their upstream migration which coincided with the winter rainy season, and their less restrictive preferences for spawning gravels, steelhead could have utilized at least hundreds of miles of smaller tributaries not accessible to the earlier-spawning salmon (Yoshiyama *et al.* 1996). Many historical populations of CCV steelhead are entirely above impassable barriers and may persist as resident or adfluvial rainbow trout, although they are presently not considered part of the DPS. Steelhead were found as far south as the Kings River (and possibly Kern river systems in wet years) (McEwan 2001). Native American groups such as the Chunut people have had accounts of steelhead in the Tulare Basin. A Chunut informant interviewed by Latta (1977) attested to the presence of steelhead in Tulare Lake.

Nobriga and Cadrett (2003) compared coded wire tagged (CWT) and untagged (wild) steelhead smolt catch ratios at Chipps Island trawl from 1998 through 2001 to estimate that about 100,000 to 300,000 steelhead juveniles are produced naturally each year in the Central Valley. Good *et al.* (2005) made the following conclusion based on the Chipps Island data:

> Existing wild steelhead stocks in the Central Valley are mostly confined to the upper Sacramento River and its tributaries, including Antelope, Deer, and Mill creeks and the Yuba River. Populations may exist in Big Chico and Butte creeks and a few wild steelhead are produced in the American and Feather rivers (McEwan and Jackson 1996). Snorkel surveys from 1999 to 2002 indicate that steelhead are present in Clear Creek. Because of the large resident *O. mykiss* population in Clear Creek, steelhead spawner abundance has not been estimated.

Monitoring has detected small self-sustaining populations of steelhead in the Stanislaus, Mokelumne, and Calaveras rivers, and other streams previously thought to be devoid of steelhead (McEwan 2001). On the Stanislaus River, steelhead smolts have been captured in rotary screw traps at Caswell State Park and Oakdale each year since 1995 (S.P. Cramer and Associates, Inc. 2000, 2001). Zimmerman *et al.* (2008) has documented CCV steelhead in the Stanislaus, Tuolumne, and Merced rivers based on otolith microchemstry.

It is possible that naturally spawning populations exist in many other streams but are undetected due to lack of monitoring programs (Interagency Ecological Program [IEP] Steelhead Project Work Team 1999). Incidental catches and observations of juvenile migrant CCV steelhead also have occurred on the Tuolumne and Merced rivers during fall-run Chinook salmon monitoring activities, indicating that steelhead are widespread throughout accessible streams and rivers in the Central Valley (Good *et al.* 2005). CDFG staff have prepared catch summaries for juvenile migrant CCV steelhead on the San Joaquin River near Mossdale, which represents migrants from the Stanislaus, Tuolumne, and Merced rivers. Based on trawl recoveries at Mossdale between 1988 and 2001, as well as rotary screw trap efforts in all three tributaries, CDFG (2003) stated that it is "clear from this data that rainbow trout [assumed to be *O. mykiss*] do occur in all the tributaries as migrants and that the vast majority of them occur on the Stanislaus River." The documented returns on the order of single fish in these tributaries suggest that existing populations of CCV steelhead on the Tuolumne, Merced, and lower San Joaquin rivers are severely depressed. The potential loss of these populations would severely impact CCV steelhead spatial structure and further challenge the viability of the CCV steelhead DPS.

In the Mokelumne River, East Bay Municipal Utilities District (EBMUD) has included steelhead in their redd surveys on the Lower Mokelumne River since the 1999-2000 spawning season. Based on data from these surveys, the overall trend suggests that redd numbers have slightly increased over the years (2000-2010). However, according to Satterthwaite *et al.* (2010), it is likely that most of the *O. mykiss* spawning in the Mokelumne River are non-anadromous (or resident) fish rather than steelhead. The Mokelumne River steelhead population is supplemented by Mokelumne River Hatchery production. In the past, this hatchery received fish imported from the Feather River and Nimbus hatcheries (Merz 2002). However, this practice was discontinued 11 years ago for Nimbus stock, and 3 years ago for Feather River stock.

Although there have been recent restoration efforts in the San Joaquin River tributaries, CCV steelhead populations in the San Joaquin Basin have been generally showing a continuing decline, an overall low abundance, and fluctuating return rates. Lindley *et al.* (2007) developed viability criteria for Central Valley salmonids. Using data through 2005, Lindley *et al.* (2007) found that data were insufficient to determine the status of any of the naturally-spawning populations of CCV steelhead, except for those spawning in rivers adjacent to hatcheries, which were likely to be at high risk of extinction due to extensive spawning of hatchery-origin fish in natural areas.

D. Factors Responsible for Steelhead Decline

NMFS cites many reasons for the decline of steelhead (Busby *et al.* 1996). The foremost reason for the decline in the anadromous populations of *O. mykiss* is the degradation and destruction of freshwater and estuarine habitat. Additional factors contributing to the decline of the population include water management operations, irrigation diversions, chemical pollution associated with agriculture and historic gold mining, river dredging and sand or gravel mining, hatchery operations, and riprapped levees. For example, the Central Valley and State Water projects alter historical flow volume and patterns that affect the timing of juvenile outmigration and direction of adult upstream migration of salmonids. Dredging and sand mining projects affect habitats by degrading water quality, destroying vegetative cover, and temporarily disturbing fish. Finally, the large numbers of salmonids released from hatcheries can pose a threat to wild salmonids through genetic impacts such as interbreeding, and the increased competition, predations, and fishing pressure that may result from hatchery production. In addition to the factors mentioned above, urbanization and poor land-use practices also are among the major factors affecting these species and the habitats that support them (California Resources Agency 1989).

Climate change has the potential to impact salmonids that migrate into the open ocean. The world is about 1.3°F warmer today than a century ago, and the latest computer models predict that, without drastic cutbacks in emissions of carbon dioxide and other gases released by the burning of fossil fuels, the average global surface temperature may rise by two or more degrees in the 21st century (Intergovernmental Panel on Climate Change [IPCC] 2001). Much of that increase will likely occur in the oceans, and evidence suggests that the most dramatic changes in ocean temperature are now occurring in the Pacific (Noakes 1998). Using objectively analyzed data, Huang and Liu (2000) estimated a warming of about 0.9°F per century in the northern Pacific Ocean.

Sea levels are expected to rise by 0.5 to 1.0 meters along the northeastern Pacific coasts in the next century, mainly due to warmer ocean temperatures, which lead to thermal expansion much the same way that hot air expands. This will cause increased sedimentation, erosion, coastal flooding, and permanent inundation of low-lying natural ecosystems (*e.g.*, salt marsh, riverine, mud flats) affecting salmonids. Increased winter precipitation, decreased snow pack, permafrost degradation, and glacier retreat due to warmer temperatures will cause landslides in unstable mountainous regions, and destroy fish and wildlife habitat, including salmon-spawning streams. Glacier reduction could affect the flow and temperature of rivers and streams that depend on glacier water, with negative impacts on fish populations and the habitat that supports them.

Summer droughts along the south coast and in the interior of the northwest Pacific coastlines will mean decreased stream flow in those areas, decreasing salmonid survival and reducing water supplies in the dry summer season when irrigation and domestic water use are greatest. Global warming may also change the chemical composition of the water that fish inhabit: the amount of oxygen in the water may decline, while pollution, acidity, and salinity levels may increase. This will allow for more invasive species to out compete native fish species and impact predator-prey relationships (Peterson and Kitchell 2001, Stachowicz *et al.* 2002).

Infectious disease is one of many factors that influence adult and juvenile salmonid survival. Salmonids are exposed to numerous bacterial, protozoan, viral, and parasitic organisms in spawning and rearing areas, hatcheries, migratory routes, and the marine environment (NMFS 1996, 1998). Specific diseases such as bacterial kidney disease, *Ceratomyxosis Shasta* (*C-shasta), columnaris, furunculosis,* infectious hematopoietic necrosis (IHN) virus, enteric redmouth disease (bacterial pathogen *Yersinia ruckeri*), black spot disease (bacterial pathogen *Posthodiplostomum sp*.), whirling disease (myxosporean parasite *Myxobolus cerebralis*), and erythrocytic inclusion body syndrome (bacterial pathogen *Renibacterium salmoninarium*) are known to affect steelhead and Chinook salmon (NMFS 1996, 1998). Very little current or historical information exists to quantify changes in infection levels and mortality rates attributable to these diseases; however, studies have shown that native fish tend to be less susceptible to pathogens than are hatchery reared fish. Salmonids may contract diseases that are spread through the water column (*i.e.*, waterbourne pathogens) as well as reduced resistance to pathogens through interbreeding with hatchery fish.

Temperature stress can also increase susceptibility to disease, and may result from a variety of factors, including seasonal changes, water management activities, handling practices, and climate change. Water temperature is critical to fish physiological reaction rates and metabolic processes. As body temperature increases, biochemical reaction rates generally increase for enzyme reactions and membrane transport flux dynamics (Elliott 1981, Neill and Bryan 1991). Thermal stress occurs when the water temperature exceeds the optimal temperature range, thus initiating changes that disrupt normal physiological functions resulting in energy expended towards stress responses, potentially decreasing survivorship (Brett 1958, Fry 1971, Elliott 1981).

An increased risk of predation also may be a factor in the decline of CCV steelhead. Human-induced habitat changes such as alteration of natural flow regimes and installation of bank revetment and structures such as dams, bridges, water diversions, piers and wharves often provide conditions that both disorient juvenile salmonids and attract predators (Stevens 1961, Decato 1978, Vogel *et al.* 1988, Garcia 1989).

Although the behavior of steelhead reduces the potential for any single predator to focus exclusively on them, predation by certain species can be seasonally and locally significant. Changes in predator and prey populations along with changes in the environment, both related and unrelated to development, have been shown to reshape the role of predation (Li *et al.* 1987). Sacramento pikeminnow (*Ptychocheilus grandis*) and striped bass (*Morone saxatilis*), of the aquatic fish predators, have the greatest potential to negatively affect the abundance of juvenile salmonids in the Central Valley. These are large, opportunistic predators that feed on a variety of prey and switch their feeding patterns when spatially or temporally segregated from a commonly consumed prey. Catfish (Order Siluriformes) also have the potential to significantly affect the abundance of juvenile salmonids. Prickly sculpin (*Cottus asper*) and riffle sculpin (*C. gulosus*), and larger salmonids also prey on juvenile salmonids (Hunter 1959; Patten 1962, 1971a, 1971b.).

V. ENVIRONMENTAL BASELINE

A. Status of the Species within the Action Area

1. <u>Status of the Species within the Action Area</u>

CCV steelhead are currently federally listed as a threatened fish species. Small numbers of CCV steelhead persist in the Stanislaus, Tuolumne, and Merced rivers (McEwan 2001, Zimmerman *et al.* 2008). This indicates the possibility of small numbers of CCV steelhead to be in the vicinity of the Action Area which begins just below the confluence of the Merced River. Currently CCV steelhead are viewed as extirpated from all waters upstream of the confluence of the Merced and San Joaquin rivers (Eilers *et al.* 2010), owing to a lack of continuity of flow and resulting poor habitat in long reaches above this point. Suitable, but presently inaccessible, habitat exists in the SJR reaches near Friant Dam.

Due to poor habitat conditions in the SJR upstream of the Merced River confluence, the CDFG has operated the HFB since 1992 to redirect fall-run Chinook salmon to the Merced River, or other suitable habitat. The HFB is a resistance weir consisting of panels aligned perpendicular to the flow of the river with evenly spaced pipes that allow water, small fish, and particles to pass but generally prevent larger fish such as adult Chinook salmon from passing upstream. Typically the HFB is operated from mid-September through mid-December each year, and CDFG staff apply for a section 4(d) permit for the capture and release of any adult CCV steelhead captured at or above the barrier. The annual monitoring reports for 2005 to 2008 submitted to NMFS by CDFG indicate that no juvenile or adult CCV steelhead were detected during HFB operations (Heyne 2006, 2007, 2008, 2009).

In October 2009, the SJRRP began the release of Interim Flows, which occur in the fall to early spring. When these flows are sufficient to reach the Merced River, they could attract adult steelhead in the San Joaquin River upstream of the confluence of the Merced River. During the timeframe that the HFB is operated, CCV steelhead that reach it could be detected and potentially redirected or trapped. In 2009, one adult fall-run Chinook salmon was detected above the HFB but no CCV steelhead detections were made (Hatler 2010). In the fall of 2010, a trap was installed by CDFG and operated by Reclamation, Denver Technical Services Center to assess the barriers' effectiveness. Approximately 30 fall-run Chinook salmon were able to pass the barrier during the 2010 interim flow period (Portz *et al.* 2011). No steelhead were detected at HFB in 2010; however, bar spacing on the trap could allow steelhead that are smaller and slimmer than salmon to escape. There is no monitoring data available on the presence of CCV steelhead after the removal of the HFB in mid-December.

2. Status of Critical Habitat within the Action Area

Critical habitat for CCV steelhead has been designated; however, the majority of the action area is excluded from the critical habitat designation. Critical habitat does not extend upstream on the SJR above the confluence of the Merced River, where all monitoring and research activities are proposed to occur. The point where captured steelhead will be released (*i.e.*, just below the confluence of the San Joaquin and Merced rivers) does lie within critical habitat.

Critical habitat for CCV steelhead is defined as specific areas that contain the primary constituent elements (PCE) and physical habitat elements essential to the conservation of the species. The PCEs of freshwater salmonid habitat within the action area include: freshwater rearing habitat and freshwater migration corridors. For the portion of the action area that does lie within critical habitat there is sufficient water quantity to form and maintain physical habitat conditions that support juvenile growth and mobility and water quality and forage supporting juvenile development. Ideal freshwater migration corridors are free of migratory obstructions, with water quantity and quality conditions that enhance migratory movements. These corridors allow the upstream passage of adults, and the downstream emigration of outmigrant juveniles. Freshwater corridors are considered to have a high conservation value even if the migration corridors are significantly degraded compared to their natural state.

The section of the San Joaquin River between Sack Dam and the Merced River confluence presently provides generally poor salmonid habitat conditions and is not included as CCV steelhead critical habitat. Physical barriers, reaches with poor water quality or no surface flow, and the presence of false migration pathways have reduced habitat connectivity. Much of the surface flow in this section is from agriculture return drains or high groundwater seepage. Habitat complexity in the action area is reduced, with limited side-channel habitat or instream habitat structure, and highly altered riparian vegetation. Bypasses receive water sporadically, as necessary for flood control. Most aquatic habitat in the bypasses is therefore temporary, and its duration depends on flood flows; the bypasses are largely devoid of aquatic and riparian habitat because of efforts to maintain hydraulic conveyance for flood flows (McBain and Trush 2002).

VI. EFFECTS OF THE PROPOSED ACTION

The purpose of this section is to identify effects on listed CCV steelhead associated with Permit 16608. Permit 16608 does not authorize any intentional lethal take of ESA-listed salmonids; however, some unintentional mortality of juvenile and adult ESA-listed steelhead may occur. The adverse effects of the permit will be primarily associated with the non-lethal take of stunned live ESA-listed CCV steelhead which may result in additional stress and injury due to being handled. NMFS expects unintentional CCV steelhead mortality will be minimal as numerous measures will be taken to reduce impacts to listed species.

Capturing and handling fish causes them stress, though they typically recover fairly rapidly from the process; therefore, the overall effects of the handling are generally short-lived. The primary contributing factors to stress and death from handling are excessive doses of anesthetic, differences in water temperatures (between the original habitat and the container in which the fish are held), dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical trauma (Kelsch and Shields 1996). Stress on salmonids increases rapidly from handling if the water temperature exceeds 18° Celsius (C) or dissolved oxygen is below saturation. Fish that are transferring to holding tanks can experience trauma if care is not taken. In addition, when fish are handled by samplers to obtain measurements and other data, it is not uncommon for fish to be dropped on the ground by the handlers because fish are not sedated enough or properly restrained. This can result in internal injuries, especially in females with developing ovaries (Stickney 1983). An injured fish is more susceptible to developing diseases which can lead to delayed mortality. Some of the injuries which can lead to disease are the loss of mucus, loss of scales, damage to integument and internal damage (Stickney 1983, Kelsch and Shields 1996). In addition to the risks associated with handling, all fish handled will be exposed to additional risks specific to the various methods of capture described in the following subsection.

Electrofishing

Electrofishing is a process by which an electrical current is passed through water in order to stun fish and facilitate capture. It can also be used to guide or block their movements. There are three general systems for electrofishing related to where the generator is maintained: backpack, boat, and shore. Backpack electrofishing is the most common system used for salmonids. Boat and shore electrofishing units often use more current than backpack electrofishing equipment because they are used to cover larger (and deeper) areas and, as a result, potentially have a greater impact on fish. This biological opinion only considers boat (raft) electrofishing.

Three technicians work together while raft electrofishing. One person will operate the boat and the main controller of the electroshocker's generator. Two people will be in position as netters, one of which will have control of the pedal to turn the electricity on (push) and off (release) for safety of the crew and the fish.

The use of electricity to capture fish is potentially one of the most intrusive and risky methods. This method of capture can result in a variety of effects from simple harassment to injury to fish (adults and juveniles) and death. There are two major forms of injuries from electrofishing: hemorrhages in soft tissue and fractures in hard tissue. Only a few recent studies have examined the long-term effects of electrofishing on salmonid survival and growth (Dalbey *et al.* 1996, Ainslie *et al.* 1998). Dalbey *et al.* (1996) reports that the growth of rainbow trout was markedly lower when there was moderate to severe electrofisher induced spinal injury. Electrofishing can also result in trauma to fish from stress. The stress caused by electrofishing is usually not recognized because the fish often appear normal upon release. Recovery from this stress can take up to several days, and during this time the fish are more vulnerable to predation, and less able to compete for resources. Stress related deaths can also occur within minutes or hours of release, with respiratory failure usually the cause.

The age or stage of development of the target species affects injury rates. Electrofishing can have severe effects on adult salmonids, particularly spinal injuries from forced muscle contraction. Sharber and Carothers (1988) reported that electrofishing killed 50 percent of the adult rainbow trout in their study. The relatively few studies that have been conducted on juvenile salmonids indicate that spinal injuries are substantially lower than they are for large fish. Smaller fish intercept a smaller head-to-tail potential than larger fish (Sharber and Carothers 1988) and may therefore be subject to lower injury rates (e.g., Hollander and Carline 1994, Dalbey *et al.* 1996, Thompson *et al.* 1997). McMichael *et al.* (1998) found a 5.1 percent injury rate for juvenile steelhead captured by electrofishing in the Yakima River sub-basin. Cho *et al.* (2002) showed that electrofishing has a dramatic negative effect on survival of eggs from electroshocked females (up to 93 percent mortality) and eggs electrofished post spawning (up to 34 percent mortality). To minimize harm to fish, NMFS requires researchers to follow NMFS' electrofishing guidelines (Attachment A). For example, NMFS prohibits electrofishing near spawning adults or active redds.

Electrofishing effectiveness and safety have improved over time (Bonar *et al.* 2009). Design specifications to reduce injury to fish and a comprehensive review of electrofishing literature can be found in Snyder (2003 and 2004). Direct current (DC) or low frequency pulsed direct current (PDC; $\geq$30 Hz, the lower the better) should be used over alternating current (AC), as these cause substantially fewer spinal injuries and hemorrhages than higher frequency PCDs and AC (Snyder 2003, 2004; Fredenberg 1992, Dalbey et al. 1996).

<u>Fyke nets with wing walls and fish traps</u>

Fyke nets have long been used to capture migrating fish to monitor their yearly movement and temporal distribution, and abundances. This type of net tends to be the most useful in capturing fish that follow the shorelines at different times of the day during the fish migration season. The fyke net entraps fish, restricts freedom of movement, and confines sometimes several species of fish to a small area, but does not constrain respiration (Hopkins and Cech 1992). Hopkins and Cech (1992) performed a field study that compared stress effects of striped bass captured in both gill nets and fyke traps in freshwater. Their results indicated that fyke trapping appeared less physiologically injurious than gill netting for capturing adult striped bass in freshwater. A comparative study for steelhead was not found; however, the striped bass study was performed in the Central Valley system where conditions are comparable to what steelhead could experience.

For this particular research and monitoring study, the fyke net is specifically designed to minimize effects on adult steelhead as the 2.54-cm mesh is small enough to prevent gilling, the netting is knotless to avoid abrasion, and they are fine and soft (softer than nylon) multi-fiber polyester to prevent scale loss (Donald E. Portz, Bureau of Reclamation, Technical Serivces Center, personal communication, 2012).

Steelhead specific trammel nets

Trammel nets may be used in all parts of the water column, in fresh or marine habitats, and are used around the world (Beamesderfer *et al.* 2005). However, they can also be used to drift in rivers for short durations with the current (Hubert 1996). Trammel nets are advantageous and relatively efficient in turbid waters. It includes three parallel vertical layers of netting. The inner net has a very small mesh size, while the outer nets have mesh size large enough for fish to pass. The larger and smaller mesh size nets form a pocket when fish attempt to swim through. Similar to seine nets, trammel nets are equipped with floats attached to the head rope and lead weights along the ground rope. If being used in a drifting application, a short duration drifting of the trammel net is necessary to prevent fish from being entangled for long periods of time. Depending on the size of the fish caught as well as the composition and size of the net material and mesh, trammel nets may have similar effects as a gill net or tangle net by catching fish by the gills, teeth, maxillary or other protrusion in one of the three panels (Beamesderfer *et al.* 2005). There is a 1 percent chance of mortality on all fish species caught with trammel nets; however, these are smaller species that become gilled (Eric Best, Bureau of Reclamation, Technical Services Center, personal communication). In salmon research, observed mortality with trammel nets is less than for gill nets (Hubert 1996).

For this research and monitoring study, the trammel net is specifically designed to be used on steelhead in order to minimize possible effects (*i.e.*, gilling, skin abrasion, loss if scales, loss of slime coat). The mesh is 2.54 cm to prevent gilling adults, it is knotless to avoid abrasion, and it is a fine, multi-fiber polyester (softer than nylon) to prevent scale loss (Portz, personal communication). This net consists of three parallel vertical layers of netting. The inner net has a very small mesh size, while the outer nets have mesh size large enough for fish to pass. The net will be drifted for 10 minutes for each sampling effort. This will minimize the amount of time that fish are confined to the net and resulting chance for injury or increased stress.

A. Adverse Effects to ESA-listed Salmonids

No intentional lethal take is requested as part of this permit. Active capture techniques pose some risk or injury or death to fish being collected and transported. Poor water quality and visibility in the action area prohibit the use of direct observation techniques for estimating fish abundance. The presence of rooted and floating aquatic vegetation prohibit the use of nets in some locations. The large size of the action area, combined with areas of excessive depth and water quality (conductivity), severly limit the effectiveness of using backpack electroshockers. A raft-mounted electroshocker will be used in order to navigate through a variety of water depths and adequately cover the selected monitoring locations in the large action area. The same guidelines for initial and maximum settings for backpack electroshocking will be followed in raft-mounted electroshocking. By using trained crews and reducing handling stress, sampling mortality can be minimized.

B. Benefits of Issuing Permit 16608

The benefits derived from the monitoring survey and research proposed under Permit 16608 are:

(1) The research will provide capture and rescue during the sampling season of CCV steelhead that would not have access to suitable spawning habitat further upstream in the San Joaquin River due to the presence of numerous passage impediments. Captured individuals will be transported downstream of the mouth of the Merced River where suitable habitat is accessible.

(2) This research will provide data on listed CCV steelhead abundance and trends in the action area between mid-December to mid-March for years 2012 through 2014. Following the removal of the HFB in mid-December and prior to the release of Vernalis Adaptive Management Plan (VAMP) or VAMP-like flows originating from the tributaries on the lower San Joaquin River, there is potential for CCV steelhead to be attracted by SJRRP interim and/or restoration flows into the San Joaquin River upstream of the confluence of the Merced River.

(3) This research will assist in identifying steelhead use of false migration pathways (*i.e.*, Mud and Salt Sloughs and Newman Wasteway) as well as the Eastside and Mariposa bypasses between the mid-December to mid-March sampling season.

C. Measures to Reduce the Impacts of Permit 16608

The following measures will be implemented to minimize any adverse impacts on ESA-listed salmonids during research activities:

(1) Fyke nets will be checked at least daily by trained biologists. These staff would be present to collect, hold, and release fish as quickly as possible (holding and release procedures are described below).

(2) Trammel nets will have trained staff present during the entire time of their deployment. As biologists will be present to collect, hold, and release fish, this is expected to minimize negative effects.

(3) The raft-mounted electroshocker will be operated according to the NMFS guidelines (Attachment A) by trained biologists. In addition, it will follow the same initial and maximum settings as for backpack electrofishing.

(4) A single pass of electrofishing will occur at designated study locations once monthly. This provides shocked fish with enough time to recover from stress between the possible electrofishing capture periods.

(5) Aerated coolers (125 liters) will be used to hold captured fish during data collection and processing. One cooler will specifically hold captured CCV steelhead; the other will hold all other non-listed species. With regard to water quality, water temperature in short-term holding tanks will be similar to the originating source to avoid thermal shock when fish are being transported to a more suitable habitat. The temperature range will be buffered to ±1.0°C. Ice will be added if water temperature increases during the short-term transport. Ice added to water in the holding tank may contain chlorine (Cl_2) that may interfere with the physiological functions of steelhead. In order to keep chlorine levels below the safe holding concentration of 0.003 mg/L, an appropriate amount of AmQuel® Plus will be added for detoxification. Also during transport, ammonia (NH_3-N un-ionized) will be kept below 0.0125 mg/L and ammonia (NH_3-N Total) below 1.0 mg/L by preventing high load densities. However, AmQuel® Plus will also aid in detoxifying both un-ionized and total ammonia.

(6) The dip nets used for all capture retrieval and transport are designed to be non-abrasive to steelhead. The nets are soft and knotless to reduce scale and slime loss, and have 5 millimeter holes.

(7) Fish will not be weighed or anesthetized to reduce handling time and minimize stress.

(8) Once captured steelhead are processed, sampling will cease and the crew will transport the cooler(s) containing steelhead to the larger transport tank (2 compartments, 378 liters each).

(9) The transport tank will be immediately filled with river water prior to transport using a portable screened water pump and equipped with oxygen gas cylinders and micro-bubble diffusers to maintain dissolved oxygen levels at near saturation during transport. The tanks will be supplemented with sodium chloride to 6 parts per thousand to minimize physiological stress by decreasing ionic gradient. With regard to water quality, water temperature in short-term holding tanks will be similar to the originating source to avoid thermal shock when fish are being transported to a more suitable habitat. The temperature range will be buffered to ±1.0°C. Ice will be added if water temperature increases during the short-term transport. Ice added to water in the holding tank may contain chlorine (Cl_2) that may interfere with the physiological functions of steelhead. In order to keep chlorine levels below the safe holding concentration of 0.003 mg/L, an appropriate amount of AmQuel® Plus will be used for detoxification. Also during transport, ammonia (NH_3-N un-ionized) will be kept below 0.0125 mg/L and ammonia (NH_3-N Total) below 1.0 mg/L by preventing high load densities. However, AmQuel® Plus will also aid in detoxifying both un-ionized and total ammonia.

(10) Captured steelhead will be moved into the transport tank using a water-filled vessel to help minimize stress and loss of slime.

(11) The truck that hauls the transport tanks will be stopped after 30 minutes of transportation and each hour thereafter for visual inspection of the life-support system and fish wellbeing.

(12) Upon arrival at the release location, the transport tanks will be tempered with water from the release location using a portable pump. This will allow acclimation of the fish

to the release location's water quality (*i.e.*, temperature). However, fish may be carried into the release point via cooler in order to minimize handling time, provided water quality (*i.e.*, temperature) is suitable.

VII. CUMULATIVE EFFECTS

Cumulative effects are defined in 50 CFR § 402.02 as "those effects of future State or private activities, not involving Federal activities that are reasonable certain to occur within the action area of the Federal action subject to consultation." Future Federal actions, including the ongoing operation of dams, hatcheries, fisheries, water withdrawals, and land management activities will be reviewed through separate section 7 consultation processes and are not considered here. Non-federal actions that require authorization under section 10 of the ESA, and that are not included within the scope of this consultation, will be evaluated in separate section 7 consultations and are not considered here. Based on the information available, NMFS does not expect any cumulative effects beyond the effects of ongoing actions identified above in the Description and Status of the Species and Critical Habitat above.

After reviewing the best available scientific and commercial data regarding the current status of the ESA-listed endangered and threatened salmonids, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, it is NMFS' biological opinion that the issuance of Permit 16608 is not likely to jeopardize the continued existence of threatened CCV steelhead.

VIII. CONCLUSION

After reviewing the best available scientific and commercial data regarding status of the ESA-listed endangered and threatened salmonids in the San Joaquin River from just below the confluence with the Merced River upstream to Sack Dam, the environmental baseline for the action area, the effects of the proposed action, and cumulative effects, it is the biological opinion of NMFS that the issuance of Permit 16608, as proposed, is not likely to jeopardize the continued existence of CCV steelhead. This determination was based on the following information: (1) available data from 2005 to 2010 on the CDFG operation of the HFB has not indicated the presence of steelhead just above the confluence of the San Joaquin and Merced rivers; (2) due to water management practices over the last several decades, the CCV steelhead has been excluded from suitable spawning habitat in the San Joaquin River above the confluence with the Merced River; and (3) incorporation of protective measures during sampling and transport. It should be noted that the release of captured/rescued CCV steelhead from the study locations to the San Joaquin River is the only action that occurs in designated critical habitat. That action will not result in the destruction or adverse modification of designated critical habitat for CCV steelhead.

With regard to including Chinook salmon on the permit, the only run currently present in the action area is fall-run. They are purposely excluded from the majority of the action area by the operation of the HFB, which is designed to prevent migrating adult fall-run Chinook from straying into unsuitable habitat. However, some small numbers of fall-run have been able to pass the HFB in recent history. Those fish have been used in other permitted studies not discussed here and/or captured and transported to suitable habitat below the confluence with the Merced River. Spring-run Chinook salmon have been extirpated from the San Joaquin River. The reintroduction of spring-run Chinook salmon as part of the SJRRP will occur prior to December 31, 2012, is scheduled to occur during the period of this permit, but they shall be covered as defined under an ESA section 10(j) experimental population designation, which has not yet been defined. If the regulations as defined in that designation require permitting for spring-run Chinook salmon, the applicant will be required to seek additional authorization at that time.

IX. INCIDENTAL TAKE STATEMENT

Section 9 of the ESA and Federal regulation pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS as an act which actually kills or injures fish or wildlife. Such an act may include significant habitat modification or degradations which actually kills or injures fish or wildlife by significantly impairing essential behavior patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not the purpose of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

Permit 16608 is for intentional take of ESA-listed salmonids associated with scientific research and monitoring activities, as listed in Table 1. Incidental take of endangered or threatened species is not anticipated, therefore, none is authorized by this BO.

X. REINITIATION OF CONSULTATION

This concludes formal consultation on the issuance of Permit 16608. As provided in 50 CFR § 402.16, re-initiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if (1) the amount or extent of incidental take specified in the incidental take statement is exceeded; (2) new information reveals effects of the action that may affect ESA-listed species or critical habitat in a manner or to an extent not previously considered; (3) the identified action area is subsequently modified in a manner that causes an effect to ESA-listed species or critical habitat that was not considered in the BO; or (4) a new species is listed or critical habitat designated that may be affected by the identified action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be re-initiated immediately.

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