UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

In response refer to:
2007/01232

NOV 21 2007

Mr. Francis Piccola
Chief, Planning Division
U.S. Army Corps of Engineers
1325 J Street
Sacramento, California 95814-2922

Dear Mr. Piccola:

Please find enclosed NOAA's National Marine Fisheries Service's (NMFS) final biological opinion (BO) concerning the effects of the U.S. Army Corps of Engineers' (Corps) operation of Englebright and Daguerre Point Dams on the Yuba River in Yuba and Nevada Counties, California (proposed project) on threatened Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*), threatened Central Valley steelhead (*O. mykiss*), the respective designated critical habitats for these salmonid species, and the threatened southern Distinct Population Segment of North American green sturgeon (*Acipenser medirostris*).

On March 23, 2007, the Corps delivered to NMFS' Sacramento Area Office, an initiation package including a cover letter requesting the initiation of formal consultation under section 7 of the Endangered Species Act for the proposed project along with a biological assessment and essential fish habitat assessment for the proposed project. Included in the Corps' March 23, 2007, cover letter was a request for the extension of the timeframe covered by the 2002 BO in order to maintain coverage for the project until the current consultation could be completed and a final, long-term BO issued. On April 27, 2007, NMFS issued a condensed BO which analyzed the effects of continuation of operation of the proposed project for one year. The enclosed long-term BO supersedes the April 27, 2007, BO and shall act as the final BO for the proposed project.

Based on the best available scientific and commercial information, the enclosed biological opinion concludes that the proposed project is not likely to jeopardize the continued existence of the above-listed species, nor will it result in the adverse modification of their respective designated critical habitats. Because NMFS believes there is the likelihood of incidental take of listed species as a result of the proposed water management operations, an incidental take statement also is attached to the biological opinion. This take statement includes reasonable and prudent measures that NMFS believes are necessary and appropriate to avoid, minimize, or monitor project impacts. Terms and conditions to implement the reasonable and prudent measures are presented in the take statement and must be adhered to in order for take incidental to this project to be authorized.

Also enclosed are Essential Fish Habitat (EFH) conservation recommendations for Pacific salmon as required by the Magnuson-Stevens Fishery Conservation and Management Act (MSA), as amended (16 U.S.C. 1801 *et seq.*; Enclosure 2). This document concludes that the proposed project is likely to adversely affect the EFH of Pacific salmon in the action area and adopts the ESA reasonable and prudent measures and associated terms and conditions from the biological opinion as the EFH conservation recommendations.

Section 305(b)4(B) of the MSA requires the Corps to provide NMFS with a detailed written response within 30 days, and 10 days in advance of any action, to the EFH conservation recommendations, including a description of measures adopted by the Corps for avoiding, minimizing, or mitigating the impact of the project on EFH (50 CFR 600.920[j]). In the case of a response that is inconsistent with our recommendations, the Corps must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the proposed action and the measures needed to avoid, minimize, or mitigate such effects.

We appreciate your continued cooperation in the conservation of listed species and their habitat, and look forward to working with you and your staff in the future. If you have any questions regarding this document, please contact Mr. Michael Tucker in our Sacramento Area Office, 650 Capitol Mall, Suite 8-300, Sacramento, CA 95814. Mr. Tucker may be reached by telephone at (916) 930-3604 or by Fax at (916) 930-3629.

Sincerely,

Rodney R McInnis

Rodney R. McInnis
Regional Administrator

cc: Copy to file: ARN151422SWR2000SA5904
NMFS-PRD, Long Beach, CA

Enclosure 1

BIOLOGICAL OPINION

ACTION AGENCY:	U.S. Army Corps of Engineers
ACTIVITY:	Operation of Englebright and Daguerre Point Dams on the Yuba River, California.
CONSULTATION CONDUCTED BY:	NOAA's National Marine Fisheries Service, Southwest Region
FILE NUMBER:	151422-SWR-2006-SA00071:MET (PCTS # 2007/01232)
DATE ISSUED:	NOV 21 2007

I. CONSULTATION HISTORY

On March 27, 2002, NOAA's National Marine Fisheries Service (NMFS) issued a biological opinion (BO) which analyzed the effects of the U.S. Army Corps of Engineers' (Corps) operation of Englebright and Daguerre Point Dams on the Yuba River in Yuba and Nevada Counties, California (proposed project) on threatened Central Valley spring-run Chinook salmon (*Oncorhynchus tshawytscha*), threatened Central Valley steelhead (*O. mykiss*), and the respective designated critical habitats for these species over a 5-year period. The conclusion of the 2002 BO found that the proposed project was not likely to jeopardize the continued existence of the listed species, and was not likely to destroy or adversely modify designated critical habitat for these species over that time period. The 2002 BO was scheduled to expire on March 27, 2007.

On March 23, 2007, the U.S. Army Corps of Engineers (Corps) delivered to NMFS' Sacramento Area Office, an initiation package including a cover letter requesting the initiation of formal consultation under section 7 of the Endangered Species Act (ESA) for the proposed project along with a biological assessment (BA) and essential fish habitat (EFH) assessment for the proposed project. Included in the Corps' March 23, 2007, cover letter was a request for the extension of the timeframe covered by the 2002 BO in order to maintain coverage for the proposed project until a new consultation could be completed and a new long-term BO issued.

On April 27, 2007, NMFS issued a condensed BO which analyzed the effects of continuation of operation of the proposed project for one year. The following long-term BO supersedes the April 27, 2007, BO and shall act as the final BO for the proposed project.

II. DESCRIPTION OF THE PROPOSED ACTION

A. Delineation and Description of the Action Area

The action area is defined in 50 CFR 402.02 as all areas to be affected directly or indirectly by the Federal action, and not merely the immediate area involved in the action. The action area for this project includes the active stream channels and riparian corridors of the Yuba River starting at and including Englebright Dam and Reservoir (39°14'18"N, 121°16'07"W, Yuba River mile 23.9), downstream to the confluence with the Feather River (39°07'46"N, 121°35'56"W, Yuba River mile 0), including Daguerre Point Dam and all water diversion facilities associated with the two dams. This area shall be referred to as the lower Yuba River.

B. Description of the Proposed Action

The proposed action considered in this BO is the continuation of current Corps operations associated with Englebright and Daguerre Point Dams on the Yuba River in Yuba and Nevada counties, CA. An important component of the Corps operations is the issuance of permits, licenses, and easements to non-Federal entities for their operations of water diversion and hydroelectric facilities at or near the dams.

1. Englebright Dam

Englebright Dam is 260 feet high, stores 70,000 acre-feet of water as designed, and was constructed in 1941 to retain hydraulic mining debris. The Corps administers the operation and maintenance of Englebright Dam, which plays only a small role in the flood control operations on the Yuba River. Although hydraulic mining is no longer active in the upper reaches of the Yuba River, Englebright Dam continues to capture any hydraulic mining debris and other sediments washed into the reservoir from upstream areas. Englebright Dam has no fish ladders, making it a complete barrier to upstream fish passage. The majority of releases from the reservoir are made through two hydroelectric power facilities, one of which (Narrows II) is located just below the base of the dam and the other (Narrows I), is located approximately 0.2 mile downstream. Water releases from the reservoir are administered by the Yuba County Water Agency (YCWA) and Pacific Gas and Electric Company (PG&E) for hydroelectric power generation, irrigation and maintenance of the downstream riverine ecosystem. The Corps has issued Easement No. DACW05-9-95-604 to PG&E for Narrows I and Easement No. DACW05-2-75-716 to YCWA for Narrows II, granting permission for the powerhouses to be constructed, operated, and maintained at the dam. Furthermore, on March 28, 1994, the Corps entered into an agreement with PG&E for operation and maintenance of the Narrows I Hydroelectric Project. The 1994 agreement states that the Corps is responsible for maintaining Englebright Dam and the outlet facilities in good order and repair, while PG&E is responsible for operation and maintenance of the hydroelectric facility.

Following the construction of New Bullards Bar Dam in 1969, the burden of flood control for the Yuba Basin was shifted from Englebright Lake to New Bullards Bar Reservoir, and Englebright Lake has since been kept nearly full most of the time (Federal Energy Regulatory Commission [FERC] 1992). As water is released from New Bullards Bar Dam for uses such as hydroelectric

power, irrigation, and fisheries, the typical drawdown from July to December in Englebright Lake is about 9 feet. Water is released either through the Narrows I powerhouse (capacity of 730 cubic feet per second [cfs]) or through the Narrows II powerhouse (capacity of 3,425 cfs). If Englebright Lake is full, surface water from the lake spills over the dam in excess of what can be handled through the hydroelectric power facilities. The flows into Englebright Lake are managed upstream at New Bullards Bar Reservoir and to a lesser extent, at other upstream reservoirs, which are filled by natural runoff from the North, Middle, and South Yuba River sub-basins.

2. Daguerre Point Dam

The Rivers and Harbors Act of 1902 authorized the construction of the Yuba River Debris Control Project, of which Daguerre Point Dam is a part. Daguerre Point Dam is an overflow concrete ogee ("s-shaped") spillway with concrete apron and concrete abutments. The ogee spillway section is 575 feet wide and 25 feet tall. The purpose of Daguerre Point Dam was to retain hydraulic mining debris. This purpose was later modified to include diversion of water for irrigation purposes. The dam is not operated for flood control and there is no water storage capacity as the entire reservoir has been filled with hydraulic mining debris and sediments. When the California Debris Commission was decommissioned, they turned administration of the dam over to the Corps. There are two irrigation diversions licensed by the Corps and a third diversion that does not require a license, which depend on the elevated head created by the dam to gravity-feed their canals. The park personnel of the Corps administer the operation of the fish ladders and maintenance of Daguerre Point Dam.

The Corps has issued easements and/or licenses for two diversions in the vicinity of Daguerre Point Dam. Initially, License DACW05-3-83-593 was first issued to Brophy Water District on August 29, 1983. This license is no longer in force since it was discovered to be a duplicate. License number DACW05-3-85-537 was issued to South Yuba Water District on March 15, 1985, and it is currently in a hold-over status, as it expired in March 2000. Easement No. DACW05-2-98-612 was issued to YCWA on October 19, 1998, but it was revoked in March 1999. On November 3, 1911, a perpetual license was issued to the Hallwood Irrigation Company. The Corps has assigned License No. DAW05-3-97-549 to this perpetual license.

Approximately 1,000 feet upstream of Daguerre Point Dam on the south side of the river, the South Yuba-Brophy diversion diverts water through an excavated channel from the Yuba River's south bank. The South Yuba-Brophy diversion is fitted with a loose cobble weir which, although intended to protect juvenile fish from becoming entrained into the canal, does not meet California Department of Fish and Game (DFG) or NMFS screening criteria. The Brophy Water District uses the South Yuba-Brophy diversion for drawing 35,330 acre-feet of water annually from the Yuba River. It is gravity fed with some lift stations. The service area is being expanded to 16,000 acres. The area covered along the Yuba River is in the southern portion of the county from the Yuba Goldfields southward to Erle Road and west to about Griffith Avenue.

The Hallwood-Cordua diversion is located on the north side of Daguerre Point Dam with the intake facilities directly connected to the superstructure of the dam. There is an interim fish screen on the Hallwood-Cordua Canal approximately 0.25 mile down the canal from the river,

which was rebuilt in the spring of 2000 by the Cordua Irrigation District. Although the new screen does not fully meet all DFG and NMFS criteria, the rehabilitation efforts have greatly improved the effectiveness of the screen by creating favorable hydrological conditions along the face of the screen, allowing continuous operation of the screen throughout the irrigation season and providing direct return of entrained fish back to the river below the dam. The Hallwood-Cordua diversion provides irrigation water to the District 10 - Hallwood area. The Hallwood Irrigation District is entitled to 78,000 acre-feet of Yuba River water annually, and the Cordua District is entitled to 82,000 acre-feet annually.

Approximately 4,200 feet upstream of Daguerre Point Dam, the Brown's Valley Canal diverts water from the north bank of the river at estimated flows of up to 100 cfs. The water enters an excavated side channel and is then pumped up into the canal. Currently, these pumps are screened with a device that meets DFG and NMFS screening criteria. Although this diversion depends on the elevated head provided by Daguerre Point Dam to draw its water, it is not licensed by the Corps as it has no direct physical link to Corps property. The Brown's Valley Diversion serves a 50,000-acre area for irrigation from Englebright Dam to the Brown's Valley and Loma Rica areas north to the Butte County line. The Brown's Valley Irrigation District is entitled to 25,687 acre-feet annually. The water is drawn primarily from Merle Collins Reservoir on Dry Creek (tributary to the lower Yuba River) and some from the Yuba River.

YCWA has contractual agreements to deliver water to these irrigation districts (QUAD Consultants, 1994). The three diversions have a combined capacity of 1,085 cfs.

The fish ladders on Daguerre Point Dam have been destroyed by floods several times over the life of the dam. The current ladders which were constructed in 1938 consist of 8- by 10-foot bays arranged in steps with about 1 foot of elevation between steps. Extensions to the fish ladders were added in 1964, and slide gates, which also permit the passage of fish, were added to both upstream ends of the ladders in 1965 (Corps 2001).

Under project authority, the Corps works with DFG to maintain the two fish ladders by clearing debris when needed. In 2000, the Corps also implemented dredging of the sediment in the area immediately above the exit of the north fish ladder as a conservation measure to provide improved fish passage. In coordination with the U.S. Fish and Wildlife Service (FWS), DFG, and NMFS, the Corps has participated in a fish passage improvement study of Daguerre Point Dam (Corps 2001). Alternatives examined include a wide range of actions ranging from removal of the dam to constructing new state-of-the-art fish ladders.

3. Conservation and restoration measures

The Corps has also committed to incorporate several conservation and restoration measures as part of their project operations which are intended to reduce take of listed salmonids by alleviating some of the adverse impacts associated with the ongoing projects. The following measures are part of the Corps' project description:

1. The Corps will coordinate with the California Department of Water Resources, U.S. Bureau of Reclamation, YCWA, Federal Energy Regulatory Commission, PG&E,

NMFS, DFG, and FWS in managing flows from New Bullards Bar Reservoir and Englebright Lake to further enhance critical habitat and water temperature in the Yuba River downstream of Englebright Lake.

2. The Corps will coordinate with NMFS, DFG, and the FWS on developing and implementing an economical gravel injection program in key areas (*i.e.*, immediately downstream of Englebright Dam and potentially other pool/riffle interface areas on the lower Yuba River) to increase the amount of suitable spawning gravels below Englebright Dam. The final environmental assessment was circulated in the summer of 2007 and the pilot gravel injection program is scheduled to begin in November of 2007.

3. The Corps will continue to implement its plan of routinely clearing debris from the two fish ladders. In 2003, a log boom was added to the north ladder exit to divert some of the debris away from the ladder. The plan will be added to the requirements contained in the Corps Operation and Maintenance Manual for Daguerre Point Dam during the next regularly scheduled Manual update. The Corps has been implementing the debris management plan since 2003.

4. The Corps will continue to implement its plan to routinely remove the sediment that accumulates in front of the north ladder exit to prevent blockage of upstream passage of fish exiting the ladder. The plan will be added to the requirements contained in the Corps Operation and Maintenance Manual for Daguerre Point Dam during the next regularly scheduled Manual update. This sediment management plan has been implemented since 2003 and has recently been refined and updated. The final updated plan was submitted as an addendum to the March 27, 2007, annual report to NMFS.

5. The Corps will coordinate with YCWA, the Brophy Irrigation District, NMFS, DFG, and the FWS to conduct a feasibility study to investigate the potential design, location and costs of a replacement screen at the South Yuba/Brophy diversion that will meet all current DFG and NMFS fish screen criteria for anadromous salmonids. This effort is already underway, and the group is currently in the process of selecting its final alternative to meet the screen criteria.

III. STATUS OF LISTED SPECIES AND DESIGNATED CRITICAL HABITAT

The following Federally listed species evolutionary significant units (ESU) or distinct population segments (DPS) and designated critical habitat occur in the action area and may be affected by the proposed project:

Central Valley spring-run Chinook salmon ESU (*Oncorhynchus tshawytscha*)
threatened (June 28, 2005, 70 FR 37160)
Central Valley spring-run Chinook salmon designated critical habitat
(September 2, 2005, 70 FR 52488)
Central Valley steelhead DPS (*Oncorhynchus mykiss*)
threatened (December 22, 2005)

Central Valley steelhead designated critical habitat
(September 2, 2005, 70 FR 52488)
Southern DPS of North American green sturgeon (*Acipenser medirostris*)
threatened (April 7, 2006, 70 FR 17386)

Since the 2002 BO became final on March 27, 2002, the status of Central Valley spring-run Chinook salmon and Central Valley steelhead has been updated, but essentially remains the same as previous designations. On June 28, 2005, NMFS issued its final decision to retain the status of Central Valley spring-run Chinook salmon as threatened (70 FR 37160). Critical habitat for Central Valley spring-run Chinook salmon and Central Valley steelhead was designated on numerous streams and stream reaches throughout the Central Valley, including the lower Yuba River from the mouth upstream to Englebright Dam, on September 2, 2005 (70 FR 52488). On January 5, 2006, NMFS issued a final decision that defined Central Valley steelhead as a Distinct Population Segment (DPS) rather than an Evolutionary Significant Unit (ESU), and retained the status of Central Valley steelhead as threatened (71 FR 834). The southern DPS of North American green sturgeon was listed as threatened on April 7, 2006, (70 FR 17386). Critical habit for the southern DPS of North American green sturgeon has not yet been designated.

A. Species Life History and Habitat Requirements

1. Spring-run Chinook Salmon

Chinook salmon exhibit two generalized freshwater life-history types (Healey 1991). "Stream-type" Chinook salmon enter freshwater months before spawning and reside in freshwater for a year or more following emergence, whereas "ocean-type" Chinook salmon spawn soon after entering freshwater and migrate to the ocean as fry or parr within their first year. Spring-run Chinook salmon exhibit a stream-type life history. Adults enter freshwater in the spring, hold over summer, spawn in fall, and the juveniles typically spend a year or more in freshwater before emigrating. Adequate instream flows and cool water temperatures are more critical for the survival of Chinook salmon exhibiting a stream-type life history due to over summering by adults and/or juveniles.

Chinook salmon mature between two and six years of age (Myers *et al.* 1998). Freshwater entry and spawning timing generally are thought to be related to local water temperature and flow regimes (Miller and Brannon 1982). Runs are designated on the basis of adult migration timing; however, distinct runs also differ in the degree of maturation at the time of river entry, thermal regime and flow characteristics of their spawning site, and the actual time of spawning (Myers *et al.* 1998). Adult spring-run Chinook salmon enter the Delta from the Pacific Ocean beginning in January and enter natal streams from March to July (Myers *et al.* 1998). In Mill Creek, Van Woert (1964) noted that of 18,290 spring-run Chinook salmon observed from 1953 to 1963, 93.5 percent were counted between April 1 and July 14, and 89.3 percent were counted between April 29 and June 30. During their upstream migration, adult Chinook salmon require streamflows sufficient to provide olfactory and other orientation cues used to locate their natal streams. Adequate streamflows also are necessary to allow adult passage to upstream holding habitat. Bell (1991) identifies the preferred water temperature for adult spring-run Chinook salmon migration as 38 °F to 56 °F. Boles (1988) recommends water temperatures below 65 °F for adult

Chinook salmon migration, and Lindley *et al.* (2004) report that adult migration is blocked when temperatures reach 70 °F, and fish can become stressed as temperatures approach 70 °F.

Spawning Chinook salmon require clean, loose gravel in swift, relatively shallow riffles or along the margins of deeper runs; suitable water temperatures, depths, and velocities for redd construction; and adequate oxygenation of incubating eggs. Chinook salmon spawning typically occurs in gravel beds that are located at the tails of holding pools (FWS 1995). The upper preferred water temperature for spawning Chinook salmon is 55 °F to 57 °F (Chambers 1956, Reiser and Bjornn 1979). A draft Physical Habitat Simulation Model (PHABSIM) report (FWS 2007) found that spring-run Chinook salmon suitable spawning velocities in the lower Yuba River are between 0.29 feet per second (fps) and 4.4 fps, with an optimal range of 2.3 to 2.4 fps, and suitable spawning substrates are between 1.3 and 4.6 inches in diameter. The draft habitat suitability curve showed suitable spawning depths ranging from 1.5 feet to 5.2 feet with an optimum range between 1.9 and 2.0 feet deep

Incubating eggs are vulnerable to adverse effects from floods, siltation, desiccation, disease, predation, poor gravel percolation, and poor water quality. Studies of Chinook salmon egg survival to hatching conducted by Shelton (1955) indicated 87 percent of fry emerged successfully from large gravel with adequate subgravel flow. The length of time required for eggs to develop and hatch is dependent on water temperature and is quite variable. Alderdice and Velsen (1978) found that the upper and lower temperatures resulting in 50 percent pre-hatch mortality were 61 °F and 37 °F, respectively, when the incubation temperature was constant.

Spring-run Chinook salmon fry emerge from the gravel from November to March and spend about 3 to 15 months in freshwater habitats prior to emigrating to the ocean (Kjelson *et al.* 1981). Post-emergent fry disperse to the margins of their natal stream, seeking out shallow waters with slower currents, finer sediments, and bank cover such as overhanging and submerged vegetation, root wads, and fallen woody material, and begin feeding on small insects and crustaceans.

When juvenile Chinook salmon reach a length of 50 to 57 mm, they move into deeper water with higher current velocities, but still seek shelter and velocity refugia to minimize energy expenditures. In the mainstems of larger rivers, juveniles tend to migrate along the margins and avoid the elevated water velocities found in the thalweg of the channel. When the channel of the river is greater than 9 to 10 feet in depth, juvenile salmon tend to inhabit the surface waters (Healey 1982). Spring-run Chinook salmon emigration is highly variable (DFG 1998). Some may begin outmigrating soon after emergence, whereas others over summer and emigrate as yearlings with the onset of intense fall storms (DFG 1998). The emigration period for spring-run Chinook salmon extends from November to early May, with up to 69 percent of young-of-the-year outmigrants passing through the lower Sacramento River and Delta during this period (DFG 1998).

2. Central Valley Steelhead

Based on their state of sexual maturity at the time of river entry and the duration of their spawning migration, steelhead can be divided into two life history types: stream-maturing and ocean-maturing. Stream-maturing steelhead enter freshwater in a sexually immature condition

and require several months to mature and spawn, whereas ocean-maturing steelhead enter freshwater with well-developed gonads and spawn shortly after river entry. These two life history types are more commonly referred to by their season of freshwater entry (*i.e.* summer [stream-maturing] and winter [ocean-maturing] steelhead). Only winter steelhead are currently found in Central Valley rivers and streams (McEwan and Jackson 1996), although there are indications that summer steelhead were present in the Sacramento River system prior to the commencement of large-scale dam construction in the 1940s (Interagency Ecological Program [IEP] Steelhead Project Work Team 1999).

Winter steelhead generally leave the ocean from August through April, and spawn between December and May (Busby *et al.* 1996). Timing of upstream migration is correlated with higher flow events, such as freshets or sand bar breaches, and the associated lower water temperatures. The preferred water temperature for adult steelhead migration is 46 °F to 52 °F (McEwan and Jackson 1996, Myrick 1998, Myrick and Cech 2000). Thermal stress may occur at temperatures beginning at 66 °F and mortality has been demonstrated at temperatures beginning at 70 °F. The preferred water temperature for steelhead spawning is 39 °F to 52 °F, and the preferred water temperature for steelhead egg incubation is 48 °F to 52 °F (McEwan and Jackson 1996, Myrick 1998, Myrick and Cech 2000). The minimum stream depth necessary for successful upstream migration is 13 cm (Thompson 1972). Preferred water velocity for upstream migration is in the range of 40-90 cm/s, with a maximum velocity, beyond which upstream migration is not likely to occur, of 240 cm/s (Thompson 1972, Smith 1973).

Unlike Pacific salmon, steelhead are iteroparous, or 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 (Nickleson *et al.* 1992, 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 were relatively numerous (17.2 percent) in California streams. Most steelhead spawning takes place from late December through April, with peaks from January though March (Hallock *et al.* 1961). Steelhead spawn in cool, clear streams featuring suitable gravel size, depth, and current velocity, and may spawn in intermittent streams as well (Everest 1973, Barnhart 1986).

Steelhead rearing during the summer takes place primarily in higher velocity areas in pools, although young-of-the-year also are abundant in glides and riffles. Winter rearing occurs more uniformly at lower densities across a wide range of fast and slow habitat types. Productive steelhead habitat is characterized by complexity, primarily in the form of large and small woody material. Cover is an important habitat component for juvenile steelhead both as velocity refuge and as a means of avoiding predation (Shirvell 1990, Meehan and Bjornn 1991). Some older juveniles move downstream to rear in large tributaries and mainstem rivers (Nickelson *et al.* 1992). Juveniles feed on a wide variety of aquatic and terrestrial insects (Chapman and Bjornn 1969), and emerging fry are sometimes preyed upon by older juveniles.

Steelhead generally spend two years in freshwater before emigrating downstream (Hallock *et al.* 1961, Hallock 1989). Rearing steelhead juveniles prefer water temperatures of 45 °F to 58 °F and have an upper lethal limit of 75 °F. Reiser and Bjornn (1979) recommended that dissolved

oxygen concentrations remain at or near saturation levels with temporary reductions no lower than 5.0 mg/l for successful rearing of juvenile steelhead. During rearing, suspended and deposited fine sediments can directly affect salmonids by abrading and clogging gills, and indirectly cause reduced feeding, avoidance reactions, destruction of food supplies, reduced egg and alevin survival, and changed rearing habitat (Reiser and Bjornn 1979). Bell (1973) found that silt loads of less than 25 mg/l permit good rearing conditions for juvenile salmonids.

Juvenile steelhead emigrate episodically from natal streams during fall, winter, and spring high flows. Emigrating Central Valley steelhead use the lower reaches of the Sacramento River and the Delta for rearing and as a migration corridor to the ocean. 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. Barnhart (1986) reported that steelhead smolts in California range in size from 140 to 210 mm (fork length). Hallock *et al.* (1961) found that juvenile steelhead in the Sacramento River basin 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.

3. Southern DPS of North American Green Sturgeon

The green sturgeon is the most widely distributed member of the sturgeon family *Acipenseridae* (70 FR 17386). North American green sturgeon are found in rivers from British Columbia south to the Sacramento River, California, though their ocean range is from the Bering Sea to Ensenada, Mexico (Moyle 2002). In assessing North American green sturgeon status, NMFS determined that two DPSs exist. The northern DPS is made up of known North American green sturgeon spawning (or single stock populations) in the Rogue, Klamath and Eel rivers. The southern DPS presently contains only a single spawning population in the Sacramento River (70 FR 17386).

North American green sturgeon are an anadromous species that generally migrate upstream to spawn in fresh water between late February and late July (CDFG 2002b). In the Klamath River, the water temperature tolerance of immigrating adult North American green sturgeon reportedly ranges from 44.4 °F to 60.8 °F (6.9 °C to 16 °C), and were not found in areas of the river outside this surface water temperature range (FWS 1995a). Mature males range from 139 to 199 centimeters (cm) fork length (FL) and 15 to 30 years of age (Van Eenennaam *et al.* 2001). Mature females range from 157 to 223 cm FL and 17 to 40 years of age. Maximum ages of adult North American green sturgeon are likely to range from 60 to 70 years (Moyle 2002).

Adult North American green sturgeon are thought to spawn every three to five years (70 FR 17386), but new information suggests that spawning could occur as frequently as every two years (Stephen Lindley, NMFS, pers. comm., 2004). Spawning occurs from March through July, with peak activity from April through June (Moyle *et al.* 1995). Spawning occurs in deep turbulent river pools. Specific spawning habitat preferences are unclear, but eggs likely are broadcast over large cobble where they settle into the cracks (Moyle *et al.* 1995). North American green sturgeon reportedly prefer to spawn in water temperatures ranging from 46.4 °F to 57.2 °F (8 °C to 14 °C) (FWS 1995b; Environmental Protection Information Center *et al.* 2001; Moyle 2002). Water temperatures above 68 °F (20 °C) are reportedly lethal to North

American green sturgeon embryos (Cech *et al.* 2000; Beamesderfer and Webb 2002). North American green sturgeon females produce 60,000 - 140,000 eggs (Moyle *et al.* 1992), and they are the largest eggs (diameter 4.34 mm) of any sturgeon species (Cech *et al.* 2000).

North American green sturgeon larvae hatch at around 200 hours (at 54.9° F) after spawning, and are dissimilar to other sturgeon species in that they lack a distinct swim-up or post-hatching stage (Moyle 2002; NMFS 2002b). Optimal growth rates for North American green sturgeon juveniles reportedly occur at water temperatures of 59 °F (Cech *et al.* 2000). North American green sturgeon larvae first feed at 10 days post hatch and grow quickly, reaching a length of 66 mm and a weight of 1.8 g in three weeks of exogenous feeding. Metamorphosis to the juvenile stage is complete at 45 days. Juveniles continue to grow rapidly, reaching 300 mm in one year. Juveniles spend from one to four years in fresh and estuarine waters and disperse into salt water at lengths of 300 to 750 mm.

The North American green sturgeon is the most marine oriented of the Pacific Coast sturgeon species (NMFS 2003). Individuals apparently remain near the estuaries at first, but then migrate considerable distances in the ocean as they grow. Based on recoveries of North American green sturgeon tagged in the San Francisco Bay estuary, most North American green sturgeon migrate northward, in some cases as far as British Columbia (Moyle 2002; NMFS 2002b). Similarly, tagged North American green sturgeon from the Sacramento and Columbia rivers are primarily captured to the north in coastal and estuarine waters, with some fish tagged in the Columbia River being recaptured as far north as British Columbia (Washington Department of Fish and Wildlife (WDFW) 2002). While there is some bias associated with recovery of tagged fish through commercial fishing, the pattern of a northern migration is supported by the large concentration of North American green sturgeon in the Columbia River estuary, Willapa Bay, and Grays Harbor, which peaks in August. These fish tend to be immature; however, mature fish and at least one ripe fish have been found in the lower Columbia River (WDFW 2002). Genetic evidence suggests that most Columbia River green sturgeon are a mixture of fish spawned in other river systems including the Sacramento, Klamath, and Rogue Rivers (Israel *et al.* 2002).

Some general information is available on North American green sturgeon feeding habits. Adult North American green sturgeon scour the Sacramento-San Joaquin Delta benthos for invertebrates including shrimp, mollusks, amphipods, isopods, and small, disabled or dead fish (Environmental Protection Center *et al.* 2001). The primary diet for juvenile North American green sturgeon reportedly consists of small crustaceans, such as amphipods and opossum shrimp (CDFG 2001). As juvenile North American green sturgeon develop, they reportedly eat a wider variety of benthic invertebrates, including clams, crabs, and shrimp (CDFG 2001).

B. Status of Listed Species and Critical Habitat

1. Central Valley spring-run Chinook salmon

The Central Valley spring-run Chinook salmon ESU has displayed broad fluctuations in adult abundance, ranging from 1,403 in 1993 to 25,890 in 1982 (Table 1). The average abundance for the ESU was 12,590 for the period of 1969 to 1979, 13,334 for the period of 1980 to 1990, 6,554 from 1991 to 2001, and 16,349 since 2002. Sacramento River tributary populations in Mill,

Deer, and Butte Creeks are probably the best trend indicators for the Central Valley spring-run Chinook salmon ESU as a whole because these streams contain the primary independent populations within the ESU. Generally, these streams have shown a positive escapement trend since 1991 (Table 2). Escapement numbers are dominated by Butte Creek returns, which have averaged over 7,000 fish since 1995. During this same period, adult returns on Mill Creek have averaged 778 fish, and 1,463 fish on Deer Creek. Although recent trends are positive, annual abundance estimates display a high level of fluctuation, and the overall number of Central Valley spring-run Chinook salmon remains well below estimates of historic abundance (DFG 1998). Additionally, in 2003, high water temperatures, high fish densities, and an outbreak of Columnaris disease (*Flexibacter Columnaris*) and Ichthyophthiriasis (*Ichthyophthirius multifiis*) contributed to the pre-spawning mortality of an estimated 11,231 adult spring-run Chinook salmon in Butte Creek. Because the Central Valley spring-run Chinook salmon ESU is confined to relatively few remaining streams, continues to display broad fluctuations in abundance, and a large proportion of the population (*i.e.*, in Butte Creek) faces the risk of high mortality rates, the population is at a moderate to high risk of extinction.

Table 1. Adult spring-run Chinook salmon indexes for Mill, Deer, and Butte Creeks since 1991.

Year	Central Valley Total	Deer	Mill	Butte
1991	1,624	479	319	No data
1992	1,547	209	237	730
1993	1,403	259	61	650
1994	2,546	485	723	474
1995	9,824	1,295	320	7,500
1996	2,701	614	253	1,413
1997	1,433	466	202	635
1998	24,725	1,879	424	20,259
1999	6,069	1,591	560	3,679
2000	5,587	637	544	4,118
2001	13,463	1,622	1,100	9,605
2002	13,220	2,185	1,594	8,785
2003	8,902	2,759	1,426	4,398
2004	9,770	804	998	7,390
2005	14,312	2,239	1,150	10,625
2006	8,716	2,432	1,002	4,579

2. Central Valley Steelhead

Historic Central Valley 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). Over the past 30 years, the naturally spawned steelhead populations in the upper Sacramento River have declined substantially. 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). Steelhead escapement surveys at RBDD ended in 1993 due to changes in dam operations.

Nobriga and Cadrett (2003) compared CWT and untagged (wild) steelhead smolt catch ratios at Chipps Island trawl from 1998-2001 to estimate that about 100,000 to 300,000 steelhead juveniles are produced naturally each year in the Central Valley. In the Updated Status Review of West Coast Salmon and Steelhead (Good *et al.* 2005), the Biological Review Team made the following conclusion based on the Chipps Island data:

> "If we make the fairly generous assumptions (in the sense of generating large estimates of spawners) that average fecundity is 5,000 eggs per female, 1 percent of eggs survive to reach Chipps Island, and 181,000 smolts are produced (the 1998-2000 average), about 3,628 female steelhead spawn naturally in the entire Central Valley. This can be compared with McEwan's (2001) estimate of 1 million to 2 million spawners before 1850, and 40,000 spawners in the 1960s".

3. Southern DPS of North American Green Sturgeon

Population abundance information concerning the Southern DPS of North American green sturgeon is scant as described in the status review (NMFS 2002b). Limited population abundance information comes from incidental captures of North American green sturgeon from the white sturgeon (*Acipenser transmontanus)* monitoring program by the CDFG sturgeon tagging program (CDFG 2002c). CDFG (2002c) utilizes a multiple-census or Peterson mark-recapture method to estimate the legal population of white sturgeon captures in trammel nets. By comparing ratios of white sturgeon to green sturgeon captures, CDFG provides estimates of adult and sub-adult North American green sturgeon abundance. Estimated abundance between 1954 and 2001 ranged from 175 fish to more than 8,000 per year and averaged 1,509 fish per year. Unfortunately, there are many biases and errors associated with these data, and CDFG does not consider these estimates reliable. Fish monitoring efforts at Red Bluff Diversion Dam and Glen Colusa Irrigation District on the upper Sacramento River have captured between 0 and 2,068 juvenile North American green sturgeon per year, mostly between June and July (NMFS 2002b). The only existing information regarding changes in the abundance of the Southern DPS of North American green sturgeon includes changes in abundance at the John Skinner Fish Protection Facility between 1968 and 2001 (State facility). The estimated average annual number of North American green sturgeon taken at the State Facility prior to 1986 was 732; from 1986 on, the average annual number was 47 (70 FR 17386). For the Tracy Fish Collection Facility (Federal facility), the average annual number prior to 1986 was 889; from 1986 to 2001 it was 32 (70 FR 17386). In light of the increased exports, particularly during the previous 10 years, it is clear that the abundance of the Southern DPS of North American green sturgeon is dropping. Catches of sub-adult and adult North American green sturgeon by the IEP between 1996 and 2004 ranged from 1 to 212 green sturgeon per year (212 occurred in 2001), however, the portion of these catches that were made up of the Southern DPS of North American green sturgeon is unknown

as these captures were primarily located in San Pablo Bay which is known to consist of a mixture of the Northern and Southern population segments. Additional analysis of North American green and white sturgeon taken at the State and Federal facilities indicates that take of both North American green and white sturgeon per acre-foot of water exported has decreased substantially since the 1960's (70 FR 17386).

Larval and post larval North American green sturgeon are caught each year in rotary screw traps at the Red Bluff Diversion Dam (Gaines and Martin 2001). A total of 2,608 juvenile sturgeon were captured from 1994-2000. All were assumed to be North American green sturgeon since 124 of these fish were grown by the University of California, Davis' researchers to an identifiable size and all were North American green sturgeon. Young sturgeon appear in catches from early May through August. Most range in size from 1 to 3 inches. Catch rates were greatest in 1995 and 1996 and were lowest in 1999 and 2000 (Gaines and Martin 2001).

No North American green sturgeon have been detected during intensive salmonid monitoring efforts in Clear, Battle, Butte, Deer and Mill creeks, all of which are tributaries to the Sacramento River (Matt Brown, FWS, pers. comm., 2004; Colleen Harvey-Arrison, CDFG, pers. comm., 2004). Sampling on these tributaries includes monitoring adult passage at fish ladders (Battle Creek), snorkel surveys (Deer, Butte, Clear and Battle creeks), and rotary screw trapping (Deer, Mill, Clear, Battle and Butte creeks). Much of this monitoring has occurred during time periods when adult North American green sturgeon would be expected to be in the rivers spawning, and when juvenile North American green sturgeon would be expected to be hatching, rearing and migrating through the river systems (S.P. Cramer & Associates, Inc. 2004).

Similar monitoring activities have likewise failed to detect North American green sturgeon in the American River (Mike Healey, CDFG, pers. comm., 2004; John Hannon, U.S. Bureau of Reclamation, pers. comm., 2004; Trevor Kennedy, Fishery Foundation of California, pers. comm., 2004). These sampling efforts included snorkeling, rotary screw trapping, and seining, and were conducted during periods when adult and juvenile North American green sturgeon would have been expected to be in the river (S.P. Cramer & Associates, Inc. 2004).

Green and white sturgeon adults have been observed periodically in small numbers in the Feather River (S.P. Cramer & Associates, Inc.2004). There are at least two confirmed records of adult North American green sturgeon. There are no records of larval or juvenile sturgeon of either species, even prior to the 1960's when Oroville Dam was built. There are reports that North American green sturgeon may reproduce in the Feather River during high flow years (CDFG 2002c), but these are not specific and are unconfirmed (S.P. Cramer & Associates, Inc. 2004).

a. *Factors Affecting North American Green Sturgeon*

The principal factor for the decline of North American green sturgeon reportedly comes from the reduction of North American green sturgeon spawning habitat to a limited area of the Sacramento River (70 FR 17391). Keswick Dam is an impassible barrier blocking North American green sturgeon access to what are thought to have been historic spawning grounds upstream (70 FR 17386). In addition, a substantial amount of what may have been spawning and rearing habitat in the Feather River above Oroville Dam has also been lost (70 FR 17386). There

is a lack of historical information on presence or absence of North American green sturgeon spawning in the Feather River, and it remains unclear whether suitable spawning habitat currently is available or has ever been available in the Feather River (S.P. Cramer & Associates, Inc. 2004).

Potential adult migration barriers to the Southern DPS of North American green sturgeon include RBDD, Sacramento Deep Water Ship Channel locks, Fremont Weir, Sutter Bypass, and the Delta Cross Channel Gates on the Sacramento River; Shanghai Bench and Sunset Pumps on the Feather River (70 FR 17391); and Daguerre Point Dam on the Yuba River. The threat of screened and unscreened agricultural, municipal, and industrial water diversions to North American green sturgeon are largely unknown as juvenile sturgeon are often not identified, and the current CDFG and NMFS screen criteria are not specifically designed to protect sturgeon. Based on the temporal occurrence of juvenile North American green sturgeon and the high density of water diversion structures along rearing and migration routes, the potential threat of these diversions are found to be serious and in need of study (70 FR 17391).

CDFG (1992) found a strong correlation between mean daily freshwater outflow (April to July) and white sturgeon year class strength in the Sacramento-San Joaquin Estuary, suggesting that insufficient flow rates are likely to pose a significant threat to the Southern DPS of North American green sturgeon. It is postulated that low flow rates could dampen survival by hampering the dispersal of larvae to areas of greater food availability, hampering the dispersal of larvae to all available habitat, delaying the transportation of larvae downstream of water diversions in the Delta, or decreasing nutrient supply to the nursery, thus stifling productivity (CDFG 1992). The subject studies primarily involve the more abundant white sturgeon; however, the threats to North American green sturgeon are thought to be similar (70 FR 17391). It is important to note, however, that white sturgeon spend more time in a riverine environment than North American green sturgeon, and the aforementioned correlation may not be applicable. The full relationship between flow and North American green sturgeon year class strength has not yet been determined.

The installation of the Shasta Dam temperature control device in 1997 is thought to have improved the situations related to high water temperatures in the upper Sacramento River, although Shasta Dam has a limited storage capacity and cold water reserves could be depleted in long droughts. Water temperatures at RBDD have not been higher than 62 °F since 1995 and are within the North American green sturgeon egg and larvae optimum range for growth and survival of 59 to 66 °F (Mayfield and Cech 2004). Conversely, CDFG (2002c) has indicated that water temperatures may be inadequate for spawning and egg incubation in the Feather River during many years as the result of releases of warmed water from Thermalito Afterbay. It is likely that high water temperatures (greater than 63 °F) may deleteriously affect sturgeon egg and larval development, especially for late-spawning fish in drier water years (70 FR 17386).

Non-native species are an ongoing problem in the Sacramento-San Joaquin River and Delta systems (CDFG 2002c). One risk for North American green sturgeon associated with the introduction of non-native species involves the replacement of relatively uncontaminated food items with those that may be contaminated. For example, the non-native overbite clam, *Potamocorbula amurensis*, introduced in 1988, has become the most common food of white

sturgeon and was found in the only North American green sturgeon examined thus far (CDFG 2002c). The overbite clam is known to bioaccumulate selenium, a toxic metal (CDFG 2002c; Linville *et al.* 2002). The significance of this threat to North American green sturgeon is unclear. North American green sturgeon also are likely to experience predation by introduced species including striped bass, but the actual impacts of predation have yet to be estimated (70 FR 17392).

Contamination of the Sacramento River increased substantially in the mid-1970s when application of rice pesticides increased (70 FR 17386). Estimated toxic concentrations for the Sacramento River during 1970-1988 may have deleteriously affected striped bass larvae (Bailey *et al.* 1994). White sturgeon also may accumulate PCBs and selenium (White *et al.* 1989). While North American green sturgeon spend more time in the marine environment than white sturgeon and, therefore, may have less exposure, the Biological Review Team for North American green sturgeon has concluded that contaminants also pose some risk for North American green sturgeon. However, this risk has not been quantified or estimated.

Existing efforts are being carried out to protect North American green sturgeon. The Central Valley Project Improvement Act (CVPIA) is a Federal statue that added fish and wildlife protection, restoration, and mitigation as authorized project purposes and gave those wildlife purposes equal priority with irrigation and domestic uses. The CVPIA also gave fish and wildlife enhancement equal priority with power generation. Since the CVPIA was enacted in 1992, FWS and the U.S. Bureau of Reclamation have led an effort to implement a significant number of activities across the Central Valley including projects such as (1) river restoration, (2) land purchases, (3) fish screen projects, (4) water acquisitions for the environment, and (5) special studies and investigations. The Anadromous Fish Restoration Program (AFRP), a component of the CVPIA, implements a doubling program in an attempt to *"implement a program which makes all reasonable efforts to ensure that, by the year 2002, natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991."* The AFRP specifically applies the doubling effort toward Chinook salmon, Central Valley steelhead, striped bass, and white and North American green sturgeon. Though most efforts of the AFRP have primarily focused on Chinook salmon as a result of their listing history and status, North American green sturgeon may receive some unknown amount of benefit from these restoration efforts. For example, the acquisition of water for flow enhancement on tributaries to the Sacramento River, fish screening for the protection of Chinook salmon and Central Valley steelhead, or riparian revegetation and instream restoration projects likely would have some ancillary benefits to sturgeon. The AFRP also has invested in one North American green sturgeon research project that has helped improve our understanding of the life history requirements and temporal distribution patterns of North American green sturgeon within the southern DPS (70 FR 17398).

The California Bay-Delta Program (CALFED) is a cooperative effort of more than 20 State and Federal agencies designed to improve water quality and reliability of California's water supply while recovering the Central Valley ecosystem. The CALFED program contains four key objectives, which include water quality, ecosystem quality, water supply and levee system integrity. Many notable beneficial actions have originated and been funded by the CALFED

program including such projects as floodplain and instream restoration, riparian habitat protection, fish screening and passage projects, research regarding non-native invasive species and contaminants, restoration methods, and watershed stewardship and education and outreach programs (70 FR 17398). Prior Federal Register notices have reviewed the details of CVPIA and CALFED programs and potential benefits towards anadromous fish, particularly Chinook salmon and Central Valley steelhead (69 FR 33102).

Information received from CALFED regarding potential projects that may serve as conservation measures for North American green sturgeon indicated a total of 118 projects of various types and levels of progress funded between 1995 and 2004. Projects primarily consisted of fish screen evaluation and construction projects, restoration evaluation and enhancement activities, contaminations studies, and dissolved oxygen investigations related to the San Joaquin River Deep Water Ship Channel. Two evaluation projects specifically addressed North American green sturgeon while the remaining projects primarily address anadromous fish in general, particularly listed salmonids. The new North American green sturgeon information from research will be used to enhance our understanding of the risk factors affecting the species, thereby improving our ability to develop effective management measures. However, at present they do not directly help to alleviate threats that this species faces in the wild (70 FR 17398). All ongoing fish screen and passage studies are designed primarily to meet the minimum qualifications outlined by the NMFS and CDFG fish screen criteria. Though these improvements will likely benefit salmonids, there is no evidence showing that these measures will decrease the likelihood of North American green sturgeon mortality. While one of CALFED's goals is to recover a number of at-risk species (including North American green sturgeon) and the program has and continues to provide funding for a variety of laboratory-based research projects, there are no specific actions aimed at alleviating the primary risks that threaten the continued existence of North American green sturgeon in the wild (70 FR 17398).

Other potential conservation measures such as the opening of the RBDD gates have helped North American green sturgeon passage in the Sacramento River during the early part of their spawning season, but it is not known how effective this measure has been. In addition, the fish ladders on RBDD do not allow North American green sturgeon to pass after May 15, when the RBDD gates are closed each year (70 FR 17386). Fish salvaging efforts at the Tracy Fish Collection Facility and the Skinner Delta Fish Protective Facility in the South Delta have been operating for decades, but it is unknown whether efforts to relocate adults have resulted in restoration of spawning potential and whether the salvage of juveniles is effective (70 FR 17398). Other conservation measures targeted at anadromous salmonids, such as improving river thermal and flow regimes, are likely to improve conditions for North American green sturgeon as well (70 FR 17398).

North American green sturgeon are protected by State fishing regulations in the Sacramento-San Joaquin system. No commercial or recreational angling take of green sturgeon is permitted under State regulations. Active sturgeon enforcement often is employed in areas where sturgeon are concentrated and particularly vulnerable to the fishery (70 FR 17397).

The protective efforts described above, when evaluated pursuant to NMFS' *"Policy for Evaluation of Conservation Efforts,"* do not as yet, individually or collectively, provide

sufficient certainty of implementation and effectiveness to counter the extinction risk assessment conclusion that the southern DPS of North American green sturgeon is likely to become an endangered species in the foreseeable future throughout its range (70 FR 17398).

4. Critical Habitat

A final rule designating critical habitat for Central Valley spring-run Chinook salmon and Central Valley steelhead throughout much of the Central Valley, including the lower Yuba River, was published on September 2, 2005 (70 FR 52488). The rule became effective on January 2, 2006. As the habitat requirements for these two species are similar, this section will combine the discussion of the status of critical habitat for both species.

Clark (1929) estimated that there were 6,000 miles of salmon habitat in the Central Valley (much of which was high elevation spring-run Chinook salmon and steelhead habitat) and that by 1928, 80 percent of this habitat had been lost. Yoshiyama et al. (1996) determined that, historically, there were approximately 2,000 miles of salmonid habitat available prior to dam construction and mining and that only 18 percent of that habitat remains.

This tremendous loss of habitat and the scarcity of remaining areas that maintain all of the primary constituent elements necessary to support listed salmonids is the primary factor affecting the status of critical habitat for these fish. Since this initial loss of habitat, other factors have continued to impact the remaining critical habitat and affected the ESU/DPS ability to recover. These factors include a combination of physical, biological, and management factors such as insufficient flows, elevated water temperatures, and predation (DFG 1998).

Instream flows in several areas designated as critical habitat for spring-run Chinook salmon and steelhead (Butte Creek, Battle Creek, Yuba River, *etc.*) are controlled by upstream dams. These dams can, at times, release insufficient flows or cause severe flow fluctuations that impact the quality of critical habitat in these streams. Low summer flows (both natural and controlled) can cause elevated water temperatures in spring-run holding and spawning habitat, resulting in pre-spawning mortality and reduced reproductive success.

Increased predation is also a significant factor affecting critical habitat for spring-run Chinook salmon and steelhead. Although predation is a natural component of salmonid ecology, the rate of predation has potentially increased through the introduction of non-native predatory species such as striped bass (*Morone saxatilis*) and largemouth bass (*Micropterus salmoides*), and through the alteration of natural flow regimes and the development of structures that attract predators, including dams, bank revetment, bridges, diversions, piers, and wharfs (Stevens 1961, Vogel *et al.* 1988). In a very limited study FWS found more predatory fish at rock revetment bank protection sites between Chico Landing and Red Bluff than at sites with naturally eroding banks. On the mainstem Sacramento River, elevated rates of predation are known to occur at RBDD, Anderson-Cottonwood Irrigation Dam, Glenn-Colusa Irrigation District's pumping plant, and at south delta water diversion structures (DFG 1998). From October 1976 to November 1993, DFG conducted 10 mark and recapture experiments at the Clifton Court Forebay to estimate pre-screen losses using hatchery-reared juvenile Chinook salmon. Pre-

screen losses ranged from 69 to 99 percent. Predation from striped bass is thought to be the primary cause of those losses (DFG 1998, Gingras 1997).

IV. ENVIRONMENTAL BASELINE

The environmental baseline includes the past and ongoing human and natural factors leading to the current status of the species and designated critical habitat within the action area. When assessing the impacts of an ongoing project such as the Corps' operations of Englebright and Daguerre Point Dams on the Yuba River, the environmental baseline for that assessment comprises all past impacts including the effects of the project up to the present day. The assessment of future effects of the action (found in the following section of this document) will include the impacts to listed species and their critical habitat which will continue to be caused by operations of the projects in the future. Many of the past project effects described in the environmental baseline section will continue to affect the species in the future and must therefore be included in the assessment of the effects of the action.

A. Status of Spring-run Chinook Salmon within the Action Area

Historic accounts of the spring-run Chinook salmon population in the Yuba River prior to the impacts caused by gold mining, dam construction, and water diversions, show that large numbers of spring-run Chinook salmon were taken by miners and Native Americans as far upstream as Downieville on the North Yuba River, and that during the construction of the original Bullards Bar Dam (1921-1924), so many salmon congregated and died below the dam that they had to be burned (Yoshiyama *et al.* 1996). Due to their presence high up in the watershed, Yoshiyama concluded that these fish were spring-run Chinook salmon.

There is limited information on the current population size of spring-run Chinook salmon in the Lower Yuba River. Before 2001, when DFG conducted a study to quantify the number of adult spring-run Chinook salmon immigrating into the Yuba River by trapping fish in the fish ladder at Daguerre Point Dam, there was almost no specific information on the run timing and size of the population in the Yuba River. In the 2001 DFG study, which involved limited sampling of fish ascending the north ladder, a total of 108 adult Chinook salmon were estimated to have passed the dam between March 1, 2001, and July 31, 2001 (DFG 2002).

Spawning and carcass surveys conducted by DFG and private consultants funded by YCWA have likewise detected the persistence of spring-run Chinook salmon in the Yuba River, although none of these reports provided population estimates specifically for spring-run Chinooks salmon.

Infrared and videographic sampling on both ladders at Daguerre Point Dam since 2003 has provided more robust estimates of spring-run Chinook salmon numbers migrating into the Yuba River. However, these estimates should be considered as *minimum* numbers, as periodic problems with the sampling equipment have caused periods when fish ascending the ladders were not counted. In years when these sorts of gaps in data occurred during the spring-run migration period, it is likely that some migrating adults were not counted, and the true numbers may be higher than those reported below (DFG unpublished data). The detection of adipose fin

clips on some of these fish indicates that they were hatchery strays, most likely from the Feather River Hatchery. The short time period in which this device has been in operation, coupled with the three to four year life cycle of these fish make it difficult to determine decisive trends in the spring run population. While the recent data from 2006 and 2007 indicates a reduction in total abundance, passage in May (the primary spring-run migration month) of 2007, was the highest detected in that month since the device was installed.

Table 2. Adult spring-run Chinook salmon counted ascending Daguerre Point Dam.

	March	April	May	June	Total
2003	–	–	–	1250	1250
2004	–	2	53	376	431
2005	6	3	113	897	1013
2006	3	0	2	212	214
2007	9	2	153	78	242

Limited redd surveys during late August and September have also been conducted by DFG since 1999. These surveys have detected spawning activities starting in the first or second week of September in each year. They have not detected a bimodal distribution of spawning activities (*i.e.*, a distinct spring-run spawning period followed by a distinct Central Valley fall-run Chinook salmon (*O. tshawytscha*) spawning period) but instead have detected a slow build-up of spawning activities starting in early September and building into the main fall-run spawning period. The earliest spawning generally occurs in the upper reaches of the best spawning habitat (below the Narrows pool) and progressively moves downstream throughout the spawning season.

In addition to DFG redd surveys, FWS has recently completed an effort to collect information for an Instream Flow Incremental Methodology study in the lower Yuba River. Data on the geographical location and bathymetric distribution of 168 spring-run Chinook salmon redds was collected on September 16 to 17, September 19, and September 23 to 26, 2002. The observed 168 redds were located in the Garcia Gravel Pit Reach.

Congregations of adult Chinook salmon (approximately 30 to 100 fish) have been observed in the outlet pool at the base of Narrows II Powerhouse, generally in late August or September when the powerhouse is shut down for maintenance, and the pool becomes clear enough to see the fish (Michael Tucker, NMFS, pers. obs., September, 2003; Steve Onken, YCWA, pers. comm., April, 2004). While it is impossible to visually distinguish spring-run from fall-run Chinook salmon in this situation, the fact that these fish are congregated this far up the river at this time of year indicates that some of them are likely to be spring-run Chinook salmon.

In general, the current data indicate that adult escapement of spring-run Chinook salmon is relatively low and fluctuating, and has been greatly reduced from estimated historic levels.

B. Status of Steelhead within the Action Area

As with the spring-run Chinook salmon, there has been very little information published on population trends and absolute abundance of steelhead in the Yuba River. The vast majority of

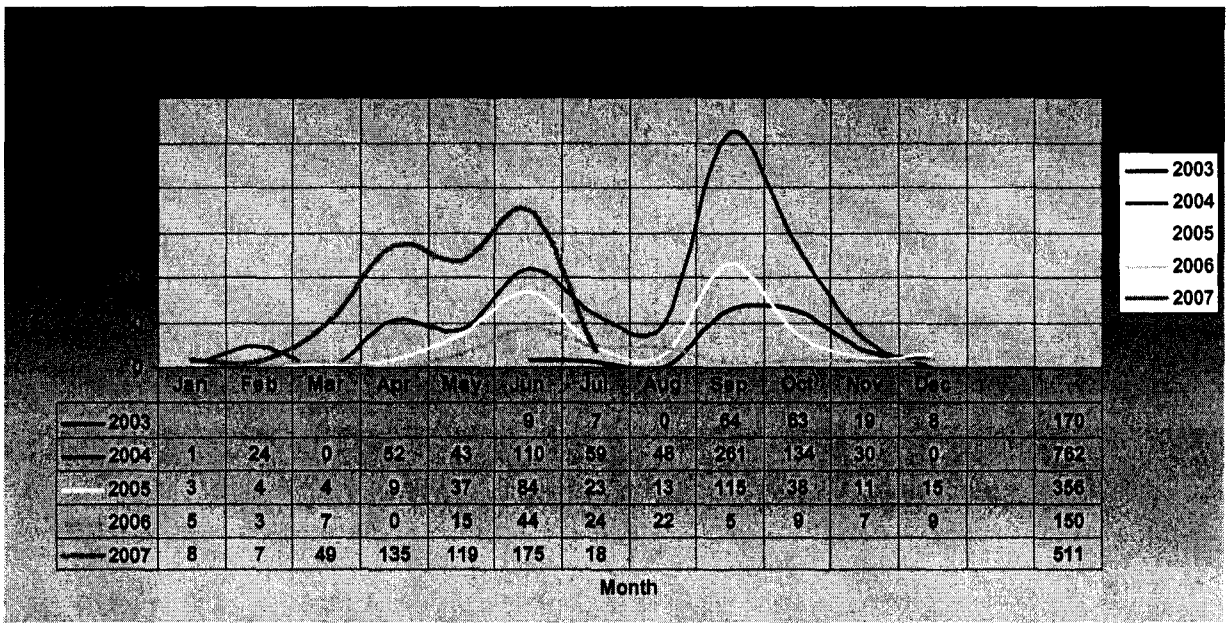
spawning and rearing habitat for steelhead in the Yuba River was first impacted by gold mining activities and then totally cut off by Englebright Dam. Prior to construction of Englebright Dam, fisheries biologists for DFG stated that they observed large numbers of steelhead spawning in the uppermost reaches of the Yuba River and its tributaries (DFG 1998, Yoshiyama *et al.* 1996).

DFG estimated a spawning population of only about 200 fish annually prior to 1969. During the 1970s, DFG annually stocked hatchery steelhead from Coleman National Fish Hatchery into the lower Yuba River, and by 1975 estimated a run size of about 2,000 fish (DFG 1991). DFG stopped stocking steelhead into the lower Yuba River in 1979, and currently manages the river to protect natural steelhead through strict "catch-and release" fishing regulations.

Infrared and videographic sampling on both ladders at Daguerre Point Dam since 2003 has provided estimates of steelhead numbers migrating up the Yuba River (Figure 1). However, these estimates should be considered as *minimum* numbers, as periodic problems with the sampling equipment have caused periods when fish ascending the ladders were not counted. Additionally, because steelhead can be similar in size and shape to many other species of fish in the Yuba River, only those inferred images that were backed up by photographic images clearly showing that the fish was a steelhead were included in the counts represented in Figure 1. It is therefore likely that the true numbers of steelhead passing Daguerre Point Dam are higher than those reported in Figure 1 (DFG unpublished data).

The data in Figure 1 indicate that 2007 steelhead passage through the first half of the month of July was the highest since the device was installed in 2003. However, as discussed above with spring-run Chinook salmon, the short time period in which this device has been in operation, coupled with the two to four year life cycle of these fish, make it difficult to determine decisive trends in the steelhead population.

Figure 1. Steelhead immigration past Daguerre Point Dam as detected through electronic monitoring in the fish ladders (DFG unpublished data).



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
2003						9	7	0	64	63	19	8	170
2004	1	24	0	62	43	110	59	48	261	134	30	0	762
2005	3	4	4	9	37	84	23	13	115	38	11	15	356
2006	5	3	7	0	15	44	24	22	5	9	7	9	150
2007	8	7	49	135	119	175	18						511

C. Status of North American Green Sturgeon within the Action Area

Adult North American green sturgeon spend the majority of their time in the ocean and estuarine environments, and only migrate into freshwater streams such as the Yuba River to spawn. Recent confirmed observations of at least one and possibly two adult North American green sturgeon in the pool below Daguerre Point Dam (SYRCL 2006) provide evidence that adult green sturgeon do utilize the lower Yuba River. Additional unconfirmed sightings of adult sturgeon (species unknown) have been periodically reported to CDFG over the past ten years (Ian Drury, CDFG, pers. comm., 2005). The fish ladders at Daguerre Point Dam were designed for salmonid passage, and it is believed that adult sturgeon are unable to ascend the structures. Periodic monitoring of these ladders for adult salmonid passage, including the use of a Vaki River Watcher system since July 2003, has detected no sturgeon passing up the ladders.

Systematic monitoring with rotary screw traps has successfully detected juvenile green sturgeon at the Red Bluff Diversion Dam on the Sacramento River in most years of sampling. While similar monitoring at several locations on the lower Yuba River using rotary screw traps has not detected the presence of juvenile sturgeon, it is possible that a small number of spawning sturgeon and/or a low reproductive success rate could go undetected by the level of monitoring effort that has occurred on the lower Yuba River. It is also possible that these fish are not attempting to spawn in the Yuba River, or that any attempts are wholly unsuccessful.

The extremely limited information on North American green sturgeon on the lower Yuba River indicates that small numbers of adults occur sporadically below Daguerre Point Dam and no successful spawning has been detected.

D. Designated Critical Habitat for Central Valley Spring-run Chinook salmon and Steelhead

Because the habitat requirements and conditions are similar for spring-run Chinook salmon and steelhead in the lower Yuba River, descriptions of the status of critical habitat for the two species will be discussed together in this section. Many of the baseline habitat conditions in the lower Yuba River have remained relatively unchanged since the completion of the 2002 BO (NMFS 2002) and should therefore be considered to be included by reference of that document. Those baseline habitat elements that have undergone significant changes since the completion of the 2002 BO are discussed below, along with a description of the changes that have occurred. Much of the following information on salmonid habitat conditions in the lower Yuba River was taken *verbatim* from the draft Implementation Plan for Lower Yuba River Anadromous Fish Habitat Restoration prepared by the Lower Yuba River Fisheries Technical Working Group (2005).

1. Fish Passage

Daguerre Point Dam can delay or prevent the upstream migration of adult spring-run Chinook salmon and steelhead in the lower Yuba River. Daguerre Point Dam includes suboptimal ladder design and sheet flow across the dam spillway that may obscure attraction to ladder entrances, particularly during high flow periods. The ladder entrances are located where the overflow from the spillway can obscure the attraction flows coming from the ladder entrances. Since 2001, wooden flash boards have been periodically affixed to the crest of the dam during low flow periods with the intent of directing the flows towards the fish ladder entrances to provide attraction flows for the ladders. Fish passage monitoring data from 2006 indicated that the installation of the flash boards resulted in an immediate and dramatic increase in the passage of salmon up the ladders, and is thought to have improved the ability for salmon to locate and enter the fish ladders (DFG unpublished data). Both ladders, particularly the north ladder, tend to clog with woody material during high flow events. A log boom was installed at the north ladder in 2003 to reduce woody material accumulation and an updated inspection and maintenance plan has allowed the Corps, in coordination with DFG, to inspect the ladders more frequently and to clean out the ladders when they become clogged with debris. Gravel buildup at the top of the ladders can block passage or reduce attraction flows at both ladders. The Corps has implemented a sediment management program to reduce gravel build up in front of the ladders and aid fish passage above the ladders since 2003.

2. Flow Fluctuations and Powerhouse Shutdowns

In 2006, YCWA constructed a full-flow bypass on Narrows II powerhouse which allows approximately 3000 cfs or 88 percent of the full 3400 cfs capacity of the powerhouse to be bypassed around the power generation facilities to maintain river flows during emergencies, maintenance, and accidental shut-downs of the powerhouse. Before this bypass was completed, flow reductions resulting from emergency and accidental shutdowns of the Narrows II powerhouse were a major concern due to adverse flow and temperature effects on listed spring-run Chinook salmon and steelhead. The ability to manage releases from Englebright Dam during maintenance and emergency operations was limited by the design of Englebright Dam and the

bypass capability of the Narrows II powerhouse which was previously only able to bypass 650 cfs or approximately 20 percent of the 3400 cfs capacity of the powerhouse.

In the past, uncontrolled flow reductions due to unexpected outages at Narrows II produced extensive adverse effects on listed steelhead and spring-run Chinook salmon in the Yuba River. Such events adversely affected spawning redds and fry/juvenile rearing areas (FERC 2001). With the completion of the full-flow bypass in 2006, these adverse effects are not expected to occur in the future.

3. Minimum Instream Flow Requirements

Flow releases from Englebright Reservoir are subject to provisions of various permits, licenses and contracts, including water rights permits and licenses administered by the State Water Resources Control Board (SWRCB), Federal Power Act License 2246, the 1966 Power Purchase Contract with PG&E, a 1965 contract with CDFG concerning instream flows, and a 1966 contract with the DWR under the Davis-Grunsky Act. YCWA determines project operations based on year-to-year analyses.

In 1962, YCWA entered into an agreement with DFG to provide the following minimum instream flows for normal water years for preserving and enhancing the fish resources in areas below Daguerre Point Dam:

- October through December - 400 cfs
- January through June - 245 cfs
- July through September - 70 cfs

Releases required by the agreement were subject to reductions in critical dry years. However, in no event were water releases to be reduced to less than 70 cfs. YCWA's Federal Power Act license also contains these requirements. In most years, YCWA voluntarily exceeded the 1962 minimum flow requirements. However, when these minimum flows were implemented they often produced water temperatures and habitat conditions which were well outside the optimal preferred ranges for salmonids.

On February 23, 1988, the SWRCB received a complaint filed by a coalition of fishery groups referred to as the United Groups regarding fishery protection and water rights issues on the lower Yuba River. In 1992 and again in 2000, the SWRCB held hearings to receive testimony and other evidence regarding fishery issues in the lower Yuba River and other issues raised in the United Groups complaint.

On July 16, 2003, the SWRCB issued its final decision (RD-1644) regarding the protection of fishery resources and other issues relating to diversion and use of water from the lower Yuba River. Among other requirements, RD-1644 specified new minimum flow requirements and flow fluctuation criteria for the lower Yuba River. Although these minimum flow requirements did not provide the level of flow protection recommended by DFG or NMFS, according to RD-1644 these flows were developed to attempt to enhance habitat for adult attraction and passage,

spawning, egg incubation, juvenile rearing, and emigration of Chinook salmon, steelhead, and American shad in the lower Yuba River.

Over the past four years a new set of instream flow schedules for the lower Yuba River has been developed through the Yuba Accord process (Surface Water Resources Inc. 2007), and these flow schedules have been implemented since 2005 under interim Accord agreements. The full Yuba Accord is expected to be finalized and implemented in early 2008. The flow schedules and other agreements associated with the Yuba Accord will extend through the life of the current FERC license for the Yuba Project (approximately 2016) and have the potential to be extended into the next license period if the Accord provisions remain amenable to the signatory parties. Key elements of the Yuba Accord Fisheries Agreement such as the initiation of improved flow schedules and funding of biological studies and habitat restoration in the lower Yuba River have provided (under the interim agreements), and are expected to continue to provide (if the long-term Accord is implemented) habitat benefits for listed species in the lower Yuba River that are at least equal to but often greater than those provided under RD-1644.

V. EFFECTS OF THE ACTION

A. Approach to the Assessment

1. Information Available for the Assessment

To conduct this assessment, NMFS examined an extensive amount of evidence and information from a variety of sources. Detailed background information on the status of these species and the potential effects of this project on these species has been taken from a number of sources including project-specific environmental reports, peer reviewed scientific journals, primary reference materials, government and non-government reports, project meetings and personal communications.

2. Assumptions Underlying this Assessment

In the absence of definitive data or conclusive evidence, NMFS will make a logical series of assumptions to overcome the limits of the available information. These assumptions will be made using sound scientific reasoning that can be logically derived from the available data. The progression of the reasoning will be stated for each assumption, and supporting evidence will be sited.

This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR 402.02. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat. NMFS will evaluate destruction or adverse modification of critical habitat by determining if the action reduces the value of critical habitat for the conservation of the species.

Because the proposed project is essentially the continuation of the Corps' operations as they have occurred in the recent past, the habitat conditions and the effects of the project that have been observed in the recent past (baseline conditions) are at times described in this section and used as

a reasonable estimation of the project effects and resultant habitat conditions that can be expected to occur into the future (effects of the action).

B. Englebright Dam

Englebright Dam blocks access by listed salmonids to the habitat above the dam, including the many large and small tributaries which make up the upper watershed. While the majority of historical spawning and holding habitat for spring-run Chinook salmon and steelhead occurred above Englebright Dam, it is unknown how much, if any, of this upstream habitat was utilized by North American green sturgeon. Because adult green sturgeon are currently blocked by Daguerre Point Dam, downstream of Englebright Dam, the only effects of Englebright Dam on green sturgeon are system wide, habitat level effects that extend downstream of Daguerre Point Dam, as described below.

Englebright Dam forces overlapping use of the same spawning areas by spring- and fall-run Chinook salmon. Spring-run salmon move into spawning streams in the spring, hold over the summer in deep, cold-water pools, and then spawn in the late summer beginning in early to mid-September (Campbell and Moyle, 1990). Under natural conditions spring-run would take advantage of high spring runoff conditions to migrate into the uppermost reaches of the Yuba watershed where they would spawn in areas spatially separated from the fall run fish. The fall-run fish enter the river later in the year and are generally unable to reach the upper reaches due to low flow conditions and their need to spawn shortly after entering fresh water. These divergent life history strategies are what have separated the two runs of Chinook salmon creating distinctive genotypic and phenotypic characteristics between the two. The existence of Englebright Dam blocks the migration of spring-run fish, forcing them to remain in the lower river where fall-run fish can "catch up" to them and spawn in the same areas. While fall-run fish generally begin spawning a little later than spring-run fish (starting in early October), there can be some overlap in timing, causing the two races to interbreed and dilute the genetics of the much smaller (in population size) spring-run. There is also the potential, in areas heavily used by spawning fall-run fish, for the later spawning fall-run to superimpose their redds onto previously laid spring-run redds thereby disrupting the spring-run redds and reducing the survival of those eggs.

Another adverse effect of Englebright Dam is that it forces fish to spawn in a limited area without the benefit of smaller tributaries which can provide some level of refuge in the event of catastrophic events such as chemical spills or massive flood events. A chemical spill in the upper Sacramento River above Lake Shasta, California, decimated the trout fishery, but this fishery has shown significant recovery due in part to the many fish that were able to escape into smaller tributaries and Lake Shasta to avoid the effects of the spill. The two tributaries that remain accessible to salmonids on the lower Yuba River are small, and one has a barrier near the mouth that prevents upstream access under most flow conditions. Major catastrophic events are rare, but have the potential to occur in any given year. The Federally listed species of the Yuba River are especially vulnerable to these events as their low population numbers and long periods of residency in the river increase the potential for a catastrophic event to significantly reduce or completely decimate their in-river populations.

Englebright Dam also prevents recruitment of spawning gravel and large woody material from upstream of the dam into the lower river. The disruption of these natural geofluvial processes reduces the quantity and quality of the PCEs of critical habitat in the lower river such as suitable spawning substrates, riparian vegetation and SRA habitat.

The elimination of access to upstream habitat coupled with the downstream impacts from Englebright Dam reduces the capacity of the Yuba River to maintain healthy, stable populations of listed anadromous fish species.

C. Daguerre Point Dam

1. Fish Passage

Daguerre Point Dam poses a complete barrier to upstream passage for North American green sturgeon. Green sturgeon are unable to ascend the fish ladders on the dam, or otherwise pass over or around the structure. The scarcity of information on North American green sturgeon in the Yuba River makes it difficult to determine how these fish are utilizing the habitat in the river, or for what purpose green sturgeon are entering the river.

It is possible that the plunge pool below Daguerre Point Dam or other deep holes downstream of the dam provide suitable habitat for green sturgeon spawning and that a small number of sturgeon utilize the lower river for spawning. It is also possible that these fish spawn in the Feather River and are then attracted by the cooler waters of the Yuba to swim up to Daguerre Point Dam and over-summer while waiting for downstream temperatures to cool to the point that they can return to the ocean. A third possibility is that green sturgeon are attracted into the Yuba River to spawn, but do not find suitable habitat below Daguerre Point Dam, and therefore do not spawn, or spawn with a reduced level of success. It is unlikely that any green sturgeon alive today could have been spawned above Daguerre Point Dam, and are attempting to return to their natal spawning habitat above the dam, because the dam has been in place longer than the expected maximum life span (60 to 70 years (Moyle 2002)) of North American green sturgeon. In any case, Daguerre Point Dam prevents North American green sturgeon from accessing a large amount of apparently suitable spawning and rearing habitat, which may be limiting the abundance, spatial structure and productivity of the population.

Upstream passage conditions at Daguerre Point Dam are also considered inadequate for Chinook salmon and steelhead throughout much of the year (CDFG 1991). Adult salmonid passage is severely impaired when rain or snowmelt runoff produces high flow conditions at the dam, which coincides with flow conditions under which spring-run Chinook salmon and steelhead generally migrate upstream to their spawning areas. Throughout winter and spring when flows are high, adult salmonids can experience difficulty in finding the entrance to the ladders because of the very small percentage of attraction flows coming out of the ladders compared to the massive sheet-flow coming over the rest of the dam. The angle of the orifices and proximity to the plunge pool also increase the difficulty for fish to find the entrances to the ladders. Other design deficiencies which have been identified include periodic obstruction of the ladders by woody material, operating criteria that require closure of the ladders at high flows, and the proximity and orientation of the ladder entrances to the spillway (CDFG 1991; USFWS 1994).

Large schools of adult salmon have been observed congregating in the plunge pool below the dam and leaping at the face of the dam, indicating that migrating adults may not readily find the entrances to the fish ladders. This lack of free passage may lead to injury, delayed migration, and/or pre-spawning mortality.

Upstream passage at Daguerre Point Dam can also be adversely impacted when sediment builds up near the upstream exit of the fish ladders. Normal geofluvial action has, in the past, caused gravel to build up on the upstream side of the dam where it can impede flows into the ladders, thereby reducing the ability of fish to climb the ladders and reducing the attraction flow coming out at the base of the ladders. In addition, the gravel bars have built up to the point where they greatly reduce access to the main channel for fish that have exited at the top of the ladders and are attempting to continue their upstream migration. The Corps has initiated a long term sediment management program to address this problem, and it is expected that this issue will be alleviated through continued diligent implementation of this program.

A simple time delay is not the only consequence of Chinook salmon being unable to pass Daguerre Point Dam. When adult Chinook salmon enter fresh water they cease eating and must rely solely on the finite supply of energy which they have stored in their bodies to last them through their entire migration, holding, and spawning activities. In their efforts to pass Daguerre Point Dam, particularly if these efforts continue for several days or even weeks, they consume a greater amount of these energy stores than if there had been no obstacle in their path. This may leave the fish in a weakened state before spawning which may subject them to a greater chance of disease, especially if they have to hold over the summer prior to spawning (*e.g.*, spring-run Chinook salmon). Other biological consequences of blockage or passage delay at Daguerre Point Dam include changes in spawning distribution (Hallock 1987), increased adult pre-spawning mortality (Reclamation 1985), and decreased egg viability (Vogel *et al.*, 1988), all of which may result in the reduction in abundance and productivity of this species.

Juvenile salmonids can also be adversely affected by Daguerre Point Dam on their downstream migration. The large plunge pool at the base of the dam creates an area of unnatural advantage for predatory fish which may seasonally congregate below Daguerre Point Dam. The deep pool provides excellent ambush habitat for predators in an area where juvenile salmonids can be disoriented or injured as they plunge over the face of the dam into the turbulent waters at the base, making them highly vulnerable to predation. High levels of predation over long periods of time can reduce juvenile numbers and weaken their contribution to year class strength and recruitment.

2. Water Diversions

There are three significant water diversions associated with Daguerre Point Dam that have a combined diversion capacity of 1,085 CFS. The three diversions include the South Yuba-Brophy diversion, the Hallwood-Cordua diversion and the Brown's Valley diversion,

The South Yuba-Brophy diversion facility includes a 450-foot long porous rock weir fitted with a fine-mesh barrier within the weir. This structure is intended to prevent fish from becoming

entrained into the diversion but it fails to meet many of the critical criteria developed by NMFS and DFG for adequate fish screen operation and fish safety.

The interstitial spaces between the rocks making up this weir are much larger than the required 3/32 inches defined in the NMFS Fish Screening Criteria for Anadromous Salmonids. There is a fine meshed fabric buried within the weir which may meet the opening size criteria (if it is still intact) but there is obviously no sweeping flow along the face of this fabric inside of the weir and therefore any fry which encounter this mesh, instead of being swept along the face of the fabric, would be more likely to become impinged on the fabric and perish.

Sweeping flows along the face of the weir are often minimal and occasionally non-existent. By agreement with the DFG, at least 10 percent of the water diverted from the Yuba River must bypass the weir structure. The stipulated 10 percent bypass flow is not always met (FWS 1990) and at times there has been no bypass flow at all with the outlet channel running completely dry (John Nelson, DFG, pers. com. 2001).

There have also been several studies which have shown that the structure does not exclude juvenile salmonids from being entrained into this diversion. On several occasions, fishery biologists have captured juvenile salmonids that were entrained behind the barrier either by passing through the weir or being washed over the top during high flows (USFWS 1990, Demko and Cramer 1994).

A mark recapture study conducted by DFG in May of 1988 found that approximately 50% of juvenile salmon that were released at the top of the intake channel were subsequently recaptured below the diversion weir in the outflow bypass channel (Konnoff 1988). It is possible that some of those fish escaped the diversion without being captured in the two fike nets which spanned the outflow channel; but even so, this data provides a strong indication that fish are being lost at this diversion.

The Corps is currently involved in a multi-agency effort to develop and implement a plan to replace the current structure with a fully compliant fish screen. However, full funding for the project has not yet been secured, and there are currently no guarantees that a new screen will be constructed.

In the spring of 2000 the fish screen on the Hallwood-Cordua diversion was rebuilt by the Cordua Irrigation District. Although the new screening facility does not fully meet all DFG and NMFS criteria, the rehabilitation efforts have greatly improved the effectiveness of the screen by creating favorable hydrological conditions along the face of the screen, allowing continuous operation of the screen throughout the irrigation season and providing direct return of entrained fish back to the river below the dam.

A state-of-the-art fish screen was installed at the Brown's Valley diversion facility in 1999 which meets all current NMFS and DFG screening criteria and is no longer considered to pose a threat of entrainment for juvenile salmonids.

All of these diversions capture water that would otherwise flow downstream to contribute to the PCEs of critical habitat below Daguerre Point Dam. This reduction in flow results in increased warming of the lower river below Daguerre Point Dam and dewatering of an incremental portion of the otherwise available aquatic habitat.

D. Critical Habitat

The impacts to critical habitat caused by the proposed project are touched upon above in the discussion of project effects on listed salmonids. Daguerre Point Dam blocks or delays fish from accessing the highest quality habitat remaining in the lower Yuba River (Narrows Pool down to Daguerre Point Dam). The interdependent water diversions at the dam capture water that would otherwise flow downstream to contribute to the PCEs of critical habitat below Daguerre Point Dam. This reduction in flow results in increased warming of the lower river below Daguerre Point Dam and dewatering of an incremental portion of the otherwise accessible critical habitat.

Englebright Dam does not block access to critical habitat (there is no designated critical habitat above the dam), but it does impact the conservation value of critical habitat below the Dam. By blocking the essential PCEs of spawning gravel and large woody material from reaching the lower river, Englebright Dam has practically eliminated viable spawning habitat in the area immediately below the dam, down through the Narrows Canyon, and greatly reduced the amount of instream cover, invertebrate food sources, and micro-habitat complexity created by instream woody material.

VI. CUMULATIVE EFFECTS

NMFS is aware of only one significant State or local action that is reasonably likely to occur in the action area. YCWA has proposed, and received approval of $3.15 million in grant funding from DWR for a Yuba Wheatland In-Lieu Groundwater Recharge and Storage Project (Wheatland Project). The purpose of the Wheatland Project is to extend the YCWA surface water delivery capabilities to the Wheatland Water District (WWD) by constructing canal facilities to deliver Yuba River Development Project (YRDP) water to the WWD in southern Yuba County (YCWA 2002).

The total future projected annual agricultural water demand for the WWD that could be served by the Wheatland Project is about 41,000 acre feet. Water will be diverted from the Yuba River at Daguerre Point Dam and conveyed to the project area through the existing South Main Canal. The new facilities will convey water from the South Main Canal to the WWD service area. The diverted water will either be provided through the direct diversion of the natural flow of the Yuba River or, during dry periods, through rediversion of stored water released from New Bullards Bar Reservoir, which is located on the North Yuba River. YCWA anticipates that the Wheatland Project potentially could divert YRDP water for delivery within the next 5 years.

YCWA (2002) estimates that the Wheatland Project would divert a maximum of an additional 160 cfs from the lower Yuba River through the South Yuba/Brophy diversion (a 40 percent

increase). This increase in total diversions through the South Yuba/Brophy diversion facility would increase the level of impacts to listed salmonids associated with exposure to this facility.

The potential increase in diversion rates at the South Yuba-Brophy diversion associated with the proposed Wheatland project is likely to cause a reduction in survival of juvenile steelhead and spring-run Chinook salmon due to entrainment and increased predation at the diversion headworks. This potential increase in entrainment would be avoided if a fish screen meeting DFG and NMFS screening criteria is installed on the diversion prior to the implementation of this program.

Results of model simulations for changes in flows in the lower Yuba River for the reach from Englebright Dam to Daguerre Point Dam show that during many summer months, flows would be higher with the Wheatland Project due to increased storage releases from Englebright Reservoir for the additional irrigation diversion deliveries downstream. Flows throughout the river during the winter would be somewhat lower with the Wheatland Project during some occasions. This reduction in flows would occur because of delay or reduction in spill amounts caused by lower storage levels, which, in turn, are the result of increased summer releases (YCWA 2002).

For the reach below Daguerre Point Dam, the Wheatland Project may result in a reduction in flows when flows would otherwise be above the minimum instream flow requirements, either because of power releases or uncontrolled flows. Changes in flow are not expected to occur if flows are already at or near the minimum instream flow requirement (YCWA 2002).

The changes in flow levels associated with implementation of the Wheatland project may be of sufficient magnitude, timing, or duration to adversely affect critical habitat and listed salmonids in the lower Yuba River. However, NMFS believes that it is likely that the benefits of increased flows in the primary spawning and rearing reaches above Daguerre Point Dam during certain periods could offset the adverse impacts to salmonids of reduced flows in the lower reaches by providing increased habitat values and reduced water temperatures in the upstream reaches during the summer and fall irrigation season. We therefore expect that the effects of potential changes in stream flows associated with the proposed Wheatland project would not cause a reduction in survival of adult steelhead or spring-run Chinook salmon, nor will it cause a net reduction in the quality of critical habitat within the Yuba River. However, the expected 40 percent increase in entrainment at the South Yuba-Brophy diversion is expected to cause a reduction in survival of juvenile steelhead and spring-run Chinook salmon in the Yuba River.

VII. INTEGRATION AND SYNTHESIS OF EFFECTS

Section 7(a)(2) of the Endangered Species Act of 1973, as amended (16 U.S.C. §1536), requires Federal agencies to ensure that their actions are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat that has been designated for those species. Regulations that implement section 7(b)(2) of the ESA define *jeopardize the continued existence of* as engaging in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and

recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 CFR 402.02). With respect to threatened and endangered species, then, Federal actions are required to ensure that their actions would not be reasonably expected to appreciably reduce the species' likelihood of both surviving and recovering in the wild, by reducing the species' reproduction, numbers, or distribution. The final step of our assessment uses the results from our effects analyses to ask (1) what is likely to happen to local populations given the exposure and responses of individual members to the effects of the proposed actions, and (2) what is likely to happen to the ESUs those populations comprise. These questions form the foundation for our jeopardy analyses.

A. Salmonids

Yuba River salmonid populations have endured almost 150 years of intense human degradation of their riverine habitat starting with hydraulic gold mining in the mid-nineteenth century and continuing through the construction of dams and the ongoing development of water for hydropower and consumptive uses. On top of these impacts, the introduction of non-native predatory fish and the degradation of riparian SRA habitat have contributed to the decline of these fish to the point that some are threatened with extinction.

The greatest impact to listed salmonids associated with the Corps' operations on the Yuba River is the complete blockage of access for these species to their historical spawning and rearing habitat above Englebright Dam. Because this historic habitat is no longer accessible, spring-run Chinook salmon and steelhead are relegated to a relatively small reach of the river containing only marginal habitat that was not historically used to any great extent for spawning by these species. This makes these fish particularly vulnerable to the project operations of the Corps.

Upstream passage at Daguerre Point Dam is often problematic for migrating salmonids due to the inadequacies of the fish ladders. Delays in passage and the expenditure of excess energy in attempting to pass dams have been shown to have a number of adverse effects on pre-spawning salmonids. Adverse impacts associated with entrainment of juvenile salmonids may occur within the irrigation diversions associated with Daguerre Point Dam. There is also an elevated risk of predation created when juveniles plunge over the dam into the pool below. The diversion of water out of the Yuba River at Daguerre Point Dam reduces flows below the dam which may result in increased water temperatures and reduced quality and quantity of the PCEs of critical habitat.

B. North American Green Sturgeon

Daguerre Point Dam blocks North American green sturgeon from accessing the area between Daguerre Point and Englebright Dams, where deep pools and colder water provide more suitable habitat for spawning and rearing of green sturgeon than the area below the dam. The lack of information on green sturgeon utilization of the Yuba River makes it difficult to determine how this blockage might affect green sturgeon abundance, productivity, spatial structure and genetic diversity, but there is the potential that all of these viability factors could be improved if green sturgeon had access to the areas above Daguerre Point Dam.

Englebright Dam reduces the amount of woody material recruited from the upper watershed into the lower Yuba River and thus reduces the amount of instream cover, invertebrate food sources, and micro-habitat complexity that could help support and improve conditions for juvenile rearing of North American green sturgeon.

C. Likelihood of ESU and DPS Survival and Recovery

In examining the potential impacts of the Corps' operations of Englebright and Daguerre Point Dams on the survival and recovery of threatened Central Valley spring-run Chinook salmon, North American green sturgeon, and Central Valley steelhead, one must determine whether or not those impacts are likely to reduce the abundance, productivity, spatial structure, and genetic and life-history diversity of these fish in such a way that their likelihood of recovery and survival within the action area is appreciably diminished. The next step is to then determine how any such local impacts are likely to affect the overall ESU/DPS throughout the Central Valley.

The long standing impacts of Englebright and Daguerre Point Dams on Central Valley spring-run Chinook salmon, Central Valley steelhead, and North American green sturgeon have affected the viability of these populations in the Yuba River. Lack of access to diverse habitats upstream of the dams reduces all four viability factors (abundance, productivity, spatial structure and genetic diversity) for these species. Juvenile losses from diversions, predation, and low-quality rearing habitat affect abundance and productivity of the populations. Reductions in spawning gravels affect productivity and spatial structure of the salmonid species, and the forced overlap of spawning habitat between spring-run and fall-run Chinook salmon affects the genetic diversity of the threatened spring-run Chinook salmon.

It is likely that the facilities and operational procedures used in the past, if left uncorrected, would cause continued declines in population viability of these species and in the conservation value of critical habitat. However, there have been several recent changes to the facilities and operational procedures related to the Corp's Yuba River operations which are expected to improve conditions for Yuba River fisheries. And recent salmonid monitoring data, while insufficient to allow detection of definite trends, do not suggest any significant, ongoing decline of salmonid populations or habitat variables in the lower Yuba River. The primary improvements that have been implemented in recent years include:

- A state-of-the-art fish screen has been constructed on the Browns Valley diversion, greatly reducing the potential for this diversion to adversely impact listed fish.

- The fish screen on the Cordua/Hallwood diversion has been completely refurbished, which has greatly reduced the potential for this diversion to adversely impact listed fish.

- Adjustable flash boards have been attached to the crest of the spillway of Daguerre Point Dam. These flashboards are designed to improve the effectiveness of the fish ladders by accomplishing the following two goals; The flashboards increase the head behind the dam, thereby forcing more water into the fish ladders during dry conditions and improving attraction and passage through the ladders; also, the positioning of the flash boards forces the water that is flowing over the dam to the outer edges of the spillway

where it provides attraction flow to the entrances to the ladders and eliminates the false attraction from flow that previously went over the middle of the dam where there is no passage.

- Beginning October 1, 2002, the Corps, in conjunction with DFG, initiated weekly inspections of the fish ladders during periods of high water and during the spring- and fall-run Chinook salmon adult migration period (approximately February through October). During the remainder of the year bi-weekly inspections have been conducted. The purpose of these inspections has been to monitor the flow levels in the ladders and any accumulation of debris in or around the ladders. Any necessary flow adjustments or removal of small debris loads are done immediately, while large debris loads are removed using heavy equipment as soon as the equipment can be mobilized to the site. A log boom was installed across the north ladder exit in April 2003 to help divert floating debris away from the ladder during low and medium flows. These measures have helped to improve passage conditions at Daguerre Point Dam by minimizing debris build-up and blockage of the ladders.

- A comprehensive sediment management plan designed to maintain a clear, open channel (at least 30 feet wide by 3 feet deep) from the fish ladder exits out across the entire width of the river was finalized in March 2007. A similar plan has been implemented since 2003, and has resulted in the maintenance of a clear passage channel allowing fish exiting the ladders to reach the main channel of the river unimpaired.

- In 2006, YCWA completed construction of a flow bypass system on the Narrows II powerhouse that allows approximately 90 percent of the total capacity of the powerhouse to be bypassed around the generation facilities and into the river during powerhouse shutdowns. In the past, uncontrolled flow reductions due to unexpected outages at Narrows II produced extensive adverse effects on listed steelhead and spring-run Chinook salmon in the Yuba River. With the completion of the full-flow bypass, these adverse effects are no longer expected to occur in the future.

1. Likelihood of survival

In considering the current baseline conditions, future cumulative effects, and the above listed recent actions taken to improve conditions on the lower Yuba River, NMFS has determined that the level of effects caused by Corps operations will be unlikely to cause a reduction in the population numbers, reproductive success or the distribution of listed fish in the Yuba River to the point of appreciably reducing these populations' likelihood of survival into the future.

2. Likelihood of recovery

In addition to the recently implemented actions and programs that are improving conditions for listed species on the Yuba River, there are several other actions and programs which are at varying stages of planning and implementation that are intended to produce significant improvements to the accessibility and quality of the habitat and viability of the populations of listed species on the Yuba River, and if fully implemented, would greatly increase the likelihood

of significant recovery of these populations. The actions and programs which are expected to provide these benefits are as follows:

a. *Yuba Accord Fisheries Agreement*

The development of the Yuba Accord has been collaborative process taking place over a period of several years. The stakeholders participating in the development of the Yuba Accord represent most of the fisheries agencies, water users, and other agencies and organizations concerned with lower Yuba River flows and other fisheries issues.

The development of the Yuba River Fisheries Agreement was the first step taken in the process that led to the Yuba Accord. The Fisheries Agreement focuses on: (1) evaluating key fisheries stressors in the lower Yuba River; (2) developing new instream flow requirements; (3) developing a monitoring and evaluation program to oversee the success of the flow schedules; and (4) creating a funding mechanism to pay for monitoring and study activities and the proposed conjunctive-use program.

The development of flow schedules for the Fisheries Agreement included biological and other science-based considerations and a stressor analysis of key fisheries species and life stages, prioritized and weighted in a summary matrix. Six flow schedules, plus a conference year schedule, were developed to cover the entire range of Yuba basin water availabilities (Tables 3 and 4). The flow schedules were developed to maximize fisheries benefits during wetter years, and to maintain fisheries benefits to the greatest extent possible for drier years while taking into account other key considerations such as water supply demands, flood control operations, and hydrologic constraints of the system.

In April of 2005, a statement of support for the proposed Fisheries Agreement was signed by YCWA, DFG, NMFS, FWS, the South Yuba River Citizens League, Friends of the River, Trout Unlimited, and the Bay institute. The Fisheries Agreement flow schedules have been implemented since 2005 under interim Accord agreements, and the full Yuba Accord is expected to be finalized and implemented in early 2008. The Fisheries Agreement and other agreements associated with the Yuba Accord will extend through the life of the current FERC license for the Yuba Project (approximately 2016) and have the potential to be extended into the next license period if the Accord provisions remain amenable to the signatory parties. Key elements of the Yuba Accord Fisheries Agreement such as the initiation of beneficial flow schedules and funding of biological studies and habitat restoration in the lower Yuba River are expected provide habitat benefits for listed species in the lower Yuba River that are at least equal to but often greater than those provided under RD-1644.

Table 3. Instream Flow Requirements for the Yuba Accord Fisheries Agreement.

Marysville Gage (cfs)

Schedule	OCT		NOV	DEC	JAN	FEB	MAR	APR		MAY		JUN		JUL	AUG	SEP	Total Annual Volume (AF)
	1-15	16-31	1-30	1-31	1-31	1-29	1-31	1-15	16-30	1-15	16-31	1-15	16-30	1-31	1-31	1-30	
1	500	500	500	500	500	500	700	1000	1000	2000	2000	1500	1500	700	600	500	574200
2	500	500	500	500	500	500	700	700	800	1000	1000	800	500	500	500	500	429066
3	500	500	500	500	500	500	500	700	700	900	900	500	500	500	500	500	396722
4	400	400	500	500	500	500	500	600	900	900	600	400	400	400	400	400	361944
5	400	400	500	500	500	500	500	500	600	600	400	400	400	400	400	400	334818
6	350	350	350	350	350	350	350	350	500	500	400	300	150	150	150	350	232155

* Indicated flows represent average volumes for the specified time period. Actual flows may vary from the indicated flows according to established criteria.
* Indicated Schedule 6 flows do not include an additional 30 TAF available from groundwater substitution to be allocated according to established criteria.

Smartville Gage (cfs)

Schedule	OCT		NOV	DEC	JAN	FEB	MAR	APR		MAY		JUN		JUL	AUG	SEP	Total Annual Volume (AF)
	1-15	16-31	1-30	1-31	1-31	1-29	1-31	1-15	16-30	1-15	16-31	1-15	16-30	1-31	1-31	1-30	
A	700	700	700	700	700	700	700	700	-	-	-	-	-	-	-	700	-
B	600	600	600	550	550	550	550	600	-	-	-	-	-	-	-	500	-

* Schedule A used with Schedules 1, 2, 3 and 4 at Marysville.
* Schedule B used with Schedules 5 and 6 at Marysville.

Table 4. Estimated Predicted Probabilities of Occurrence of the Six Flow Schedules and the Conference Year for the Yuba Accord Fisheries Agreement.

Schedule	North Yuba Index (TAF)	Percent Occurrence	Cumulative
1	>1,400	56%	56%
2	1,040 to 1,400	22%	78%
3	920 to 1,040	7%	85%
4	820 to 920	5%	90%
5	693 to 820	5%	95%
6	500 to 693	4%	99%
Conference	<500	1%	100%

b. *Gravel augmentation program.*

In 2004, the Corps completed a draft gravel augmentation/enhancement plan which included several potential alternatives for improving spawning gravel availability in the lower Yuba River. The initial preferred alternative was to implement a pilot project that would re-contour a perched gravel bar to reconnect the stranded gravels with the flowing channel. However, before this alternative could be implemented, the high flows of 2005/2006 cut into the proposed project site and essentially implemented the plan before the Corps had a chance to. Since that time, a second alternative (injection of new spawning gravels at the base of Englebright Dam) has been under investigation, and with the help of the University of California, Davis and the Anadromous Fish Restoration Program, a pilot injection of spawning gravels is scheduled to be implemented in the fall of 2007. With the knowledge gained from the study of this pilot injection, the Corps will develop and implement a long term gravel injection program which is expected to improve

spawning habitat conditions in the currently gravel starved reach immediately downstream of Englebright Dam.

c. *South Yuba/Brophy Diversion Screening*

The Corps has been participating with the Brophy Irrigation District, NMFS, DFG, and the FWS to investigate, design, and implement an economical plan to replace the current rock weir screening device on the South Yuba/Brophy Diversion with a new positive barrier fish screen that will meet all current CDF and NMFS fish screen criteria for anadromous salmonids. This group is currently in the process of selecting its preferred alternative to conduct a full feasibility and engineering design study on.

d. *Daguerre Fish Passage Improvement Project*

The Corps recognized the potential need to improve fish passage at Daguerre Point Dam and prepared a Section 216 Initial Appraisal Report in 2005 to determine if there is a Federal interest in implementing fish passage improvements. On February 24, 2006, the South Pacific Division of the Corps determined that improvements at Daguerre Point Dam are in the Federal interest. This determination has allowed the Sacramento District to request an initial $100,000 to initiate a study on the feasibility of improvements to fish passage at Daguerre Point Dam. The Sacramento District has submitted budget requests for FY07 and FY08. However, they have not been approved.

The Sacramento District will continue to request funding for the initiation of the reconnaissance phase to allow the completion of the reconnaissance report, development of a project management plan, and preparation of a cost-sharing agreement, which constitute the initial phase in the process to prepare a feasibility study to implement fish passage and habitat improvements at the projects. Once the non-Federal sponsor has signed the cost-sharing agreement, the feasibility study may commence. The feasibility study would conclude with a recommendation to the Chief of Engineers as to the project that would represent the Federal interest. The Chief of Engineers would then forward the report to the Assistant Secretary of the Army for Civil Works (ASA(CW)). Once the ASA(CW) approved the report, it would then be sent to Congress for authorization for construction. A non-Federal sponsor must be willing to share the cost of the project at the determined cost share in order for the project to move from one phase to the next.

The California Department of Water Resources (DWR) and/or the Yuba County Water Agency are the most likely non-Federal cost-sharing partners for fish passage and habitat improvements at Daguerre Point Dam. The DWR has sent a letter to the Corps, expressing interest in being the non-Federal cost-sharing partner, but has yet to sign a cost-sharing agreement. Preparation of a Section 905(b) reconnaissance report and a project management plan, which constitute the reconnaissance phase, would take up to 1 year, should funds be provided. The Corps would use this time to define problems and opportunities associated with the projects, as well as detail costs and tasks associated with the feasibility study. Since there has been a significant amount of work already conducted by the Sacramento District and DWR, it is expected that this work would take no longer than 6 months.

At this time, the Corps estimates that it would take 2 to 3 years to complete the feasibility study and prepare and receive all necessary environmental documents needed to initiate the planning, engineering and design (PED) phase to allow construction of the selected plan. It is anticipated that the feasibility study and environmental impact statement/environmental impact report (EIS/EIR) could cost $2 million to prepare, requiring a non-Federal cost share of $1 million. This effort will be simplified by the fact that the DWR, in association with Corps and the U.S. Fish and Wildlife, have prepared numerous documents describing the alternatives and benefits of various fish passage improvement scenarios, as well as begun an EIS/EIR for Daguerre Point Dam.

Based on previous studies, the Corps anticipates that the cost of a non-dam-removal alternative at Daguerre Point Dam could be as high as $30 million, and the cost for a dam modification or removal alternative could be as high as $150 million. Should a dam removal alternative be approved, it is more likely that the feasibility and PED phases would cost $10 million and take 5 years to complete, at a minimum.

e. *Upper Yuba River Studies Program*

The Upper Yuba River Studies Program is a comprehensive study program funded by the CalFed Bay Delta Program, designed to determine if the reintroduction of wild Chinook salmon and steelhead to the upper Yuba River above Englebright Dam is biologically, environmentally and socio-economically feasible over the long term. This program has conducted several detailed studies examining the suitability of the habitat above Englebright Dam and summarized the results of these studies in an administrative draft Upper Yuba River Watershed Habitat Feasibility Report. Preliminary efforts have also been initiated to examine various other issues involved with the reintroduction of anadromous salmonids to the upper watershed, including water supply and hydropower impacts, flood risk, water quality, and socio-economic issues. The program has currently exhausted its initial budget, but is continuing to pursue additional sources of funding to complete the original goals and study plans developed by the program workgroup.

While none of these proposed actions and programs have been fully implemented, and most have not been fully planned or funded, some are very close to implementation and have pilot programs that have been or are being implemented (*i.e.* the Yuba Accord Fisheries Agreement and the gravel augmentation program). The Corps has actively participated in the planning efforts of all of these projects (except for the Yuba Accord), and has listed several of the projects in their project description for Yuba River operations. Again, all of these proposals are at different stages of development, and none are absolutely certain to be fully implemented. However, the Corps has stated and demonstrated their support for the implementation of these actions, and no element of their proposed Yuba River operations would appreciably diminish the likelihood of these recovery actions being implemented on the Yuba River.

3. Critical Habitat

Many of the above-listed actions and programs (both completed and pending) are actually designed to improve the quality and quantity of the PCEs of critical habitat upon which spring-run Chinook salmon and steelhead rely. Those measures that improve flows, water temperatures,

or passage conditions, or augment spawning gravel in depleted areas, are expected to increase the conservation value of critical habitat in the Yuba River. It is therefore reasonable to expect that the Corps' proposed operations on the Yuba River should at least maintain, if not slightly improve the value of critical habitat for the conservation of spring-run Chinook salmon and steelhead above the value that was present when critical habitat was designated on the Yuba River in 2005.

VIII. CONCLUSION

After reviewing the current status of the threatened Central Valley spring-run Chinook salmon, Central Valley steelhead, and southern DPS of North American green sturgeon, the environmental baseline for the action area, the effects of future operations of Englebright Dam and Daguerre Point Dam and all other cumulative effects, it is NMFS' biological opinion that operations of Englebright Dam and Daguerre Point Dam on the Yuba River are not likely to jeopardize the continued existence of these species, and are not likely to destroy or adversely modify designated critical habitat for the salmonid species.

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, 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 kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures fish or wildlife by significantly impairing essential behavioral 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 intended as part 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.

The measures described below are nondiscretionary, and must be undertaken by the Corps so that they become binding conditions of any permits issued or project descriptions, as appropriate, for the exemption in section 7(o)(2) to apply. The Corps has a continuing duty to regulate the activities covered by this incidental take statement. If the Corps fails to assume and implement the terms and conditions, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps must report the progress of the action and its impact on the species to NMFS as specified in this incidental take statement (50 CFR §402.14(I)(3)).

While some measures described below are expected and intended to avoid, minimize, or monitor the take of North American green sturgeon, the prohibitions against taking of endangered species in section 9 of the ESA do not automatically apply to threatened species such as the recently listed southern DPS of North American green sturgeon. However, NMFS is in the process of

finalizing section 4(d) rules which will define and dictate the prohibitions against taking this threatened DPS. Therefore, NMFS advises the Corps to implement the following reasonable and prudent measures for North American green sturgeon. Once the final 4(d) rule is adopted, these measures, with their implementing terms and conditions, will become nondiscretionary for North American green sturgeon.

A. Amount or Extent of Take

NMFS cannot, using the best available information, specifically quantify the anticipated amount of incidental take of individual Central Valley spring-run Chinook salmon, Central Valley steelhead, or North American green sturgeon because of the variability and uncertainty associated with the response of listed species to the effects of the project, the population size of each species, annual variations in the timing of migration, individual habitat use within the project area, and uncertainties regarding meteorological conditions, water storage conditions and the annual variability in water management practices by upstream entities. However, it is possible to designate ecological surrogates for the extent of take anticipated to be caused by the project, and to monitor those surrogates to determine the level of take that is occurring. The three most appropriate ecological surrogates for the extent of take caused by the project are the flow releases from Englebright Dam, the availability of spawning gravel below Englebright Dam and the maintenance of clear passage through the ladders on Daguerre Point Dam.

The analysis of the effects of the proposed project anticipates that the interrelated operation of the new full flow bypass on Englebright Dam will prevent large flow fluctuations in the lower Yuba River which exceed those authorized in the FERC license for the Yuba Project (FERC license # 2246). The analysis also anticipates that a pilot gravel injection below Englebright Dam will be implemented in 2007, injecting approximately 500 tons of appropriately sized spawning gravel into the river. Finally, the analysis anticipates that the fish ladders on Daguerre Point Dam will be cleared of sediment, wood or other debris as necessary, and that a channel of adequate depth and width to allow unimpaired passage of adult salmonids will be maintained from the ladder exits to the main channel of the river. If these ecological surrogates are not met and maintained, the proposed project will be considered to have exceeded anticipated take levels, triggering the need to reinitiate consultation on the project.

B. Effect of the Take

NMFS has determined that the level of take resulting from continued operation of the proposed project is not likely to jeopardize the continued existence of Central Valley spring-run Chinook salmon or Central Valley steelhead, and is not likely to destroy or adversely modify designated critical habitat for these species.

C. Reasonable and Prudent Measures

Pursuant to section 7(b)(4) of the ESA, the following reasonable and prudent measures are necessary and appropriate to minimize take of Central Valley spring-run Chinook salmon, Central Valley steelhead, and North American green sturgeon:

1. The Corps shall develop and implement a long-term gravel augmentation program to restore quality spawning habitat below Englebright Dam.

2. The Corps shall develop and implement a long term program to replenish large woody material in the lower Yuba River.

3. The Corps shall develop and implement a plan to improve fish passage for adult and juvenile spring-run Chinook salmon, steelhead and green sturgeon at Daguerre Point Dam.

4. Until such time as reasonable and prudent measure number 3 is fully implemented, the Corps shall maintain the current fish passage facilities at Daguerre Point Dam to prevent avoidable impairment of passage of listed salmonids.

5. The Corps shall diligently pursue the ongoing effort to fully screen the South Yuba-Brophy irrigation diversion to meet all DFG and NMFS screening criteria.

D. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Corps must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

1. The Corps shall develop and implement a long-term gravel augmentation program to restore quality spawning habitat below Englebright Dam.

    A) The Corps shall utilize the information obtained from the pilot gravel injection project to develop and commence implementation of a long-term gravel augmentation program within three years of the issuance of this biological opinion.

2. The Corps shall develop and implement a long term program to replenish large woody material in the lower Yuba River.

    A) The Corps shall initiate a study to determine an effective method of replenishing the supply of large woody material that is being trapped by upstream reservoirs, back into the lower Yuba River, in a manner that provides instream cover, invertebrate food sources, and micro-habitat complexity created by instream woody material.

    B) The program described in Term and Condition 2. B. shall commence implementation (woody material will be brought to the lower Yuba River) within 4 years of the issuance of this biological opinion.

3. The Corps shall develop and implement a plan to improve fish passage for adult and juvenile spring-run Chinook salmon, steelhead and green sturgeon at Daguerre Point Dam.

   A) The Corps shall complete the feasibility study and PED phases of the ongoing fish passage improvement project, as described in the Corps biological assessment for the proposed project, within five years of the issuance of this biological opinion.

   B) The Corps shall commence implementation of the preferred alternative to improve fish passage for adult and juvenile spring-run Chinook salmon, steelhead and green sturgeon at Daguerre Point Dam, developed through the feasibility study and PED process, within ten years of the issuance of this biological opinion.

4. Until such time as reasonable and prudent measure number 2 is fully implemented, the Corps shall maintain the current fish passage facilities at Daguerre Point Dam to prevent avoidable impairment of passage of listed salmonids.

   A) The Corps shall continue to implement the fish ladder clearing and sediment management programs described in this biological opinion.

5. The Corps shall diligently pursue the ongoing effort to fully screen the South Yuba-Brophy irrigation diversion to meet all DFG and NMFS screening criteria.

   A) The Corps shall diligently pursue the ongoing effort to fully screen the South Yuba-Brophy irrigation diversion to meet all DFG and NMFS screening criteria.

X. REINITIATION OF CONSULTATION

This concludes formal consultation on the action(s) outlined in the March 23, 2007, request for consultation received from the Corps. As provided in 50 CFR §402.16, reinitiation 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 is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this draft opinion, (3) the agency action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered in this draft opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

XI. LITERATURE CITED

California Department of Fish and Game. 1991. Lower Yuba River Fisheries Management Plan. Stream Evaluation Report No. 91-1, February 1991.

California Department of Fish and Game. 1998. A report to the Fish and Game Commission: A status review of the spring-run Chinook (*Oncorhynchus tshawytscha*) in the Sacramento River drainage. Candidate Species Status Report 98-01. June 1998.

California Department of Fish and Game. 2002. Sacramento River Spring-run Chinook Salmon. 2001 Annual Report Prepared for the Fish and Game Commission. Habitat Conservation Division, Native Anadromous Fish and Watershed Branch. October 2002.

Clark, G.H. 1929. Sacramento-San Joaquin salmon (*Oncorhynchus tshawytscha*) fishery of California. Calif. Fish Game Bull. 17:73.

Federal Energy Regulatory Commission. 1992. Environmental assessment for hydropower license for the Narrows Project. FERC Project No. 1403-004. Washington, D.C.

Federal Energy Regulatory Commission. 2001. Draft Biological Evaluation. FERC Project Nos. 2246, 6780, 1403, and 2266, Yuba River, California. Washington, D.C.

Gingras, M. 1997. Mark/recapture experiments at Clifton Court Forebay to estimate pre-screen loss of juvenile fishes: 1976-1993. Interagency Ecological Program Technical Report No. 55.

Good, T.P., R.S. Waples, and P. Adams (editors). 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Dept. Commerce, NOAA Tech. Memo. NMFS-NWFSC-66, 598 p.

Hallock, R.J., W.F. Van Woert, and L. Shapavalov. 1961. An evaluation of stocking hatchery-reared steelhead rainbow trout (*Salmo gairdneri gairdneri*) in the Sacramento River system. Calif. Fish Game Fish Bull. 114, 73 p.

Lower Yuba River Fisheries Technical Working Group. 2005. Draft Implementation Plan for Lower Yuba River Anadromous Fish Habitat Restoration. Sacramento, CA.

McEwan, D.R. 2001. Central Valley Steelhead. Contributions to the biology of Central Valley salmonids. R. Brown editor. California Department of Fish and Game Fish Bulletin No. 179.

McEwan, D., and T.A. Jackson. 1996. Steelhead restoration and management plan for California. California Department of Fish and Game, 234p. (Available from California Department of Fish and Game, Inland Fisheries Division, 1416 Ninth Street, Sacramento, CA 95814.)

National Marine Fisheries Service. 2002. Biological Opinion on the Operations of Englebright Dam/Englebright Lake and Daguerre Point Dam on the Yuba River, California. Southwest Region, Sacramento Area Office.

Nobriga, M., and P. Cadrett. 2003. Differences among hatchery and wild steelhead: evidence from Delta fish monitoring programs. Interagency Ecological Program for the San Francisco Estuary Newsletter 14:3:30-38.

QUAD Consultants. 1994. Yuba County General Plan. Volume 1, Environmental Setting and Background. Prepared for Department of Planning and Building Services, Yuba County.

Stevens, D.E. 1961. Food habits of striped bass, *Roccus saxitilis* (Walbaum), in the Rio Vista area of the Sacramento River. Master's Thesis, University of California, Berkeley.

Surface Water Resources Inc. 2007. Administrative draft environmental impact report/environmental impact statement for the proposed lower Yuba River accord. Prepared for the California Department of Water Resources, Yuba County Water Agency and the U.S. Bureau of Reclamation. March 2007.

U. S. Army Corps of Engineers. 2001. Preliminary fish passage improvement study, Daguerre Point Dam, Yuba River, California.

Vogel, D.A., K.R. Marine, and J.G. Smith. 1988. Fish passage action program for Red Bluff Diversion Dam. Final Report, U. S. Fish and Wildlife Service Report No. FR1-FAO-88-19.

Yoshiyama, R. M., E. R. Gerstung, F. W. Fisher, and P. B. Moyle. 1996. Historical and present distribution of Chinook salmon in the Central Valley Drainage of California. In: Sierra Nevada Ecosystem Project, Final Report to Congress, vol. III, Assessments, Commissioned Reports, and Background Information (University of California, Davis, Centers for Water and Wildland Resources, 1996).

Yuba County Water Agency. 2002. Initial study and mitigated negative declaration for the new east side canal extension project. Yuba County, CA.

Personal Communications

Onken, Steve. 2004. YCWA Hydropower Engineer. Pers. comm. April, 2004.

Tucker, Michael. 2003. NMFS Fisheries Biologist. Pers. comm. September, 2003.