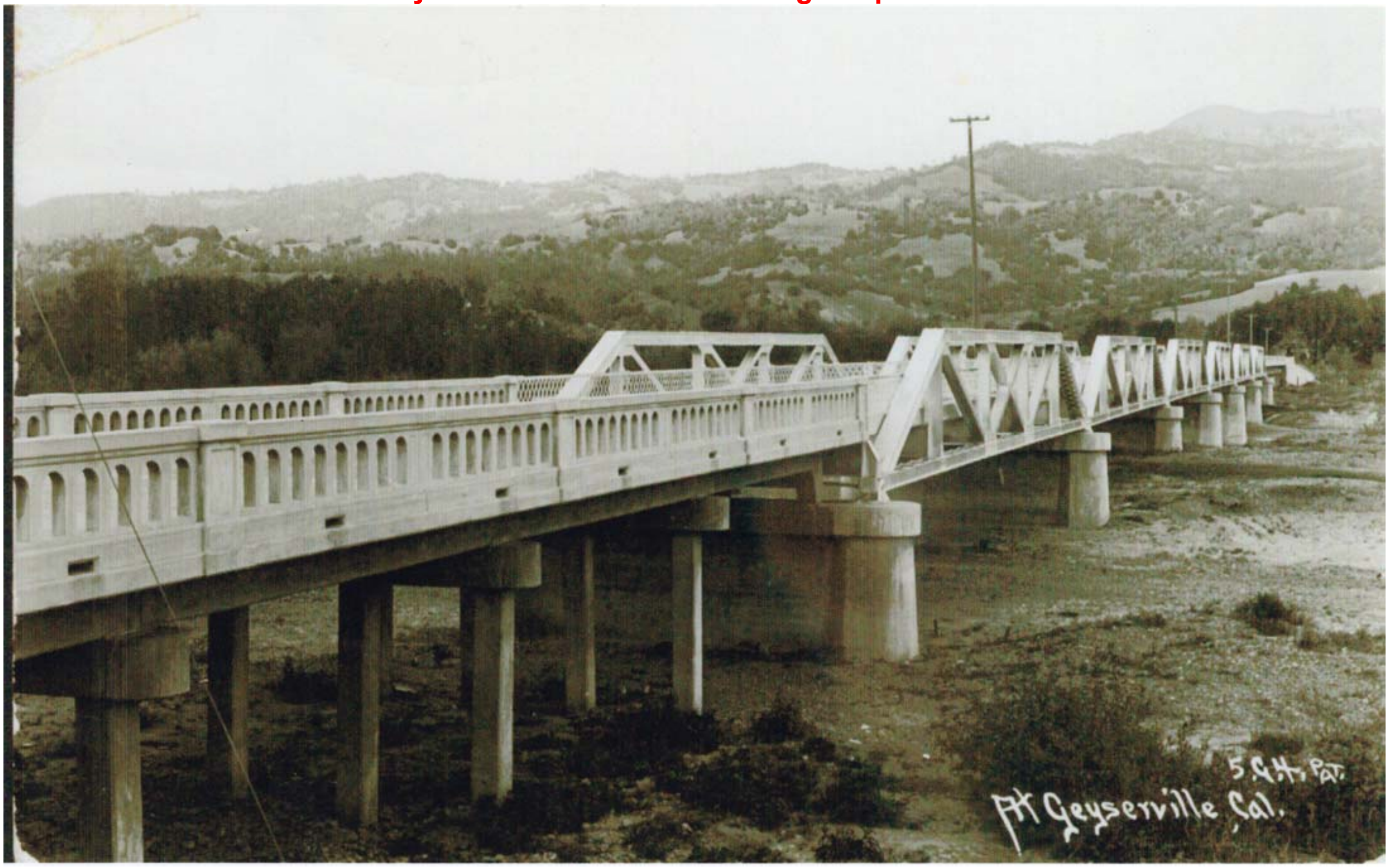
Geyserville Russian River Bridge Replacement



BIOLOGICAL ASSESSMENT

FOR THE REPLACEMENT OF THE GEYSERVILLE RUSSIAN RIVER BRIDGE on

STATE HIGHWAY 128

FOR NOAA FISHERIES

04 SONOMA 128 5.44 EA 2S8403

MARCH 2006

This Biological Assessment, pursuant to Section 7 of the Endangered Species Act of 1973, addresses the potential impact to listed salmonids which utilize the Russian River in the vicinty of the Sonoma 128 Geyserville, that was damaged during the New Years Eve storm of 2006. This Biological Assessment is forwarded through the Federal Highway Administration which is the Federal lead agency for this project.

1. Project Location

The Russian River Bridge (Br. No. 20-0038) is located just east of the town of Geyserville, Sonoma County, at PM 5.44 on State Route 128 and is in the Geyserville USGS 7.5'Quadrangle. See Figure 1. This bridge was constructed in 1932 to replace the original timber bridge constructed by Sonoma County. It has a concrete trestle section on each end and steel pony truss section at the middle span. The bridge is 24 feet wide between the curbs and 973.5 feet long. A 5-foot wide wooden walkway was constructed outside the bridge railing in 1972. Route 128 was taken into the State Highway System on August 24, 1933.

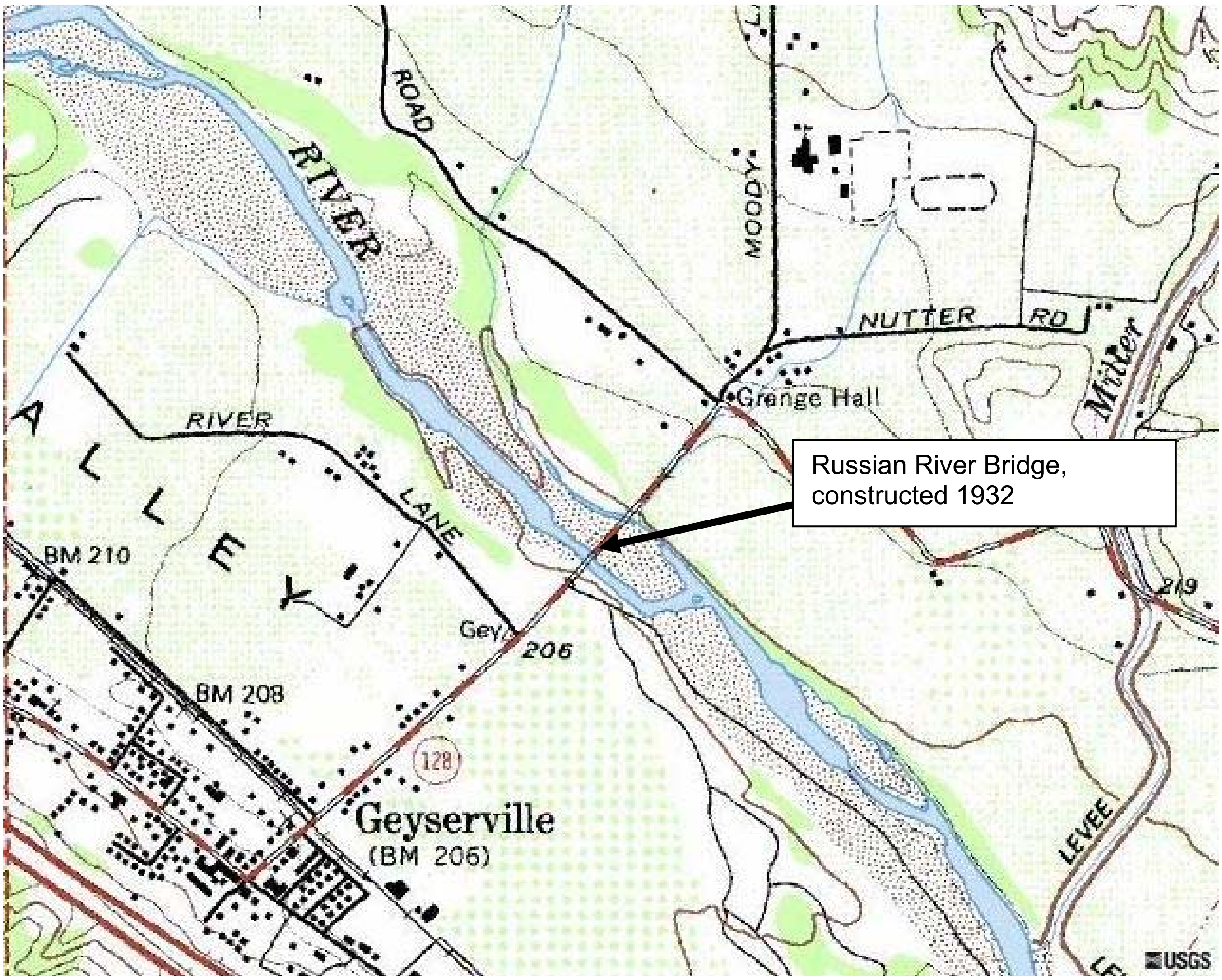


Figure 1. 1974 USGS 7.5' Geyserville Quad section

BRIDGE AND PIER INFORMATION

The bridge has seven concrete piers with footings at each end of the piers. According to the available construction plans the top of the pile cap is 6' below the web wall, is 3' thick, the tremie concrete (seal) below the cap was "not more than 2'" and that there are nine 25' fir piles per ½ pier. There are timber cofferdams enclosing most of the existing pier pile assemblages. Large rocks (1.5 – 2 ton) were placed in bridge pier scour holes in the early 1980's to help protect the piers and piles.

During the storm sequence that began just after Christmas of 2005 and peaked on New Years Day, Russian River flows peaked at over 46,300 cubic feet per second (cfs) at the Cloverdale gauge which is approximately 20 river miles upstream on December 31, 2005. At Healdsburg, approximately 19 miles downstream of the Bridge, the gauge recorded 58,900 CFS. Interpolation of this data results in approximately 52,600 cfs at the Geyserville Bridge. (CDEC information)

CONSULTATION INFORMATION

The following section details the Section 7 coordination that has occurred on this project with the NOAA Fisheries.

In a conference call between FHWA, Caltrans, and NMFS staff on February 7, 2006, and at a site visit by these staff on February 15, 2006, we had identified a mutually acceptable approach for reconstructing the bridge that would avoid potentially significant impacts to listed salmon and steelhead. A two-phase plan for the reconstruction of the bridge was proposed. The first phase entailed the immediate emergency construction of an approximately 1000 foot long trestle across the Russian River immediately adjacent to the old bridge, repairing the broken pile on the old bridge with 24-inch diameter CISS piles, and then systematically demolishing the old bridge using equipment stationed on the trestle and the old bridge. This first phase, which would occur during the migration of listed salmonids, minimized adverse effects to these fish because the trestle would be constructed using relatively small 12-inch diameter piles in watered areas and 24-inch diameter piles on non-submerged substrates. In addition, daily work would be confined to the period 8 am to 4 pm, the time of day when migrating juvenile salmonids are least active. The second phase of construction, the positioning of large diameter (48 to 60-inch diameter) piles across the Russian River channel, would be scheduled for the period June 15 through September 1 when listed salmonids are not migrating past the project site and when warm summer-time water temperatures limit the numbers of steelhead in the project area. Other measures that were discussed for this emergency reconstruction of the bridge and the temporary trestle included monitoring sound levels of the pile driving, using a vibratory hammer when installing the trestle and new bridge piles rather than an impact hammer, and using standard best management practices for limiting the project's effect on such things as riparian vegetation, bank stability, and stream water quality. We recognized that the use of an impact hammer might be required to drive the piles during the final few feet of pile placement.

On February 22, 2006, Chuck Morton of Caltrans informed Bill Hearn of NMFS that the plan described above was deemed unacceptable because of the need to expedite bridge construction so that the bridge could be completed by late June. As a result, he anticipated the installation of large diameter piles would be conducted during the spring migration of steelhead and salmon.

In a conference call on February 27, 2006, FHWA, Caltrans, and NMFS staff discussed this latest plan that would accelerate the project schedule and pose potentially substantial adverse effects to listed salmonids. FHWA explained that the accelerated schedule was due to Caltrans interest in restoring normal traffic patterns and routes for emergency vehicles as soon as possible. In particular it was stated that there was interest in having traffic resume at the bridge when school starts in early September. In addition, it was stated that, consistent with emergency funding procedures, federal emergency funding for the bridge repairs and reconstruction would terminate 180 days following the storm event that caused the emergency. The end date for this emergency funding is June 19, 2006.

During this call, FHWA and Caltrans expressed interest in working with NMFS to minimize impacts to listed salmonids. To that end FHWA and Caltrans agreed to employ the following measures to limit impacts to salmonids during the demolition of the old bridge and construction of the new bridge across the Russian River at Geyserville:

1) Construct the temporary trestle using piles: a) not greater than 24-inch diameter in areas where the riverbed is not wetted or otherwise inundated by the river, and b) not greater than 12-inch diameter where the riverbed is wetted or otherwise under water.

2) Delay installation of all large diameter permanent piles (*i.e.*, 48-60-inch diameter) as late as possible during the period March through June 15. Ideally, these large diameter piles should be installed during the period June 15 to September 1. To help minimize potential adverse effects, Caltrans and its contractors will first install large diameter piles in areas where the riverbed is <u>not</u> wetted (*i.e.*, inundated by the river), deferring installation of large diameter piles in wetted areas until the end of the period of active pile driving.

3) All pile driving activities will have a digital record of each pile strike, including pile number, pile size and type, hammer size and type, distance to wetted channel (if not in water), water depth (if in water), date and time of installation, energy imparted to pile, and number of strikes.

4) Pile driving for the new bridge shall commence with Bent 10 on the easterly end of the project and proceed westerly to Bent 6. Piles at these bents, which are at locations above the waterline, may be driven with a vibratory hammer or with an impact hammer of proper size.

5) All pile driving, both for the trestle and the new bridge, is restricted to the hours between 8 am and 4 pm.

6) Hydroacoustic monitoring and recording within the wetted active channel at various distances shall be taken during the driving of piles for Bents 2, 3, 4, and 5. Readings shall be taken at one pile per bent and include both the vibratory installation and the impact hammer driving.

7) Hydroacoustic monitoring and recording within the wetted active channel at various distances shall be taken during the driving of representative piles for the temporary trestle and for the piles necessary to stabilize the broken Pier on the old bridge.

8) Pile driving for Bents 2, 3, and 4 shall proceed with Bent 2 and proceed easterly. Piles at these bents shall be driven with a vibratory hammer until refusal and then driven to tip with an impact hammer of proper size. Pile driving for Bents 2, 3, and 4 shall be driven when the gravel bed is dry. If the gravel bed does not dry, an isolation system, as described in Number 9 below, will be utilized.

9) Pile driving for Bent 5 shall be the last piles driven. These piles, as they are likely to be in the active wetted channel, will be isolated from the water column by an isolation casing of adequate size to accommodate the placement of an air bubble curtain between the isolation casing and pile.

10) Piles at Bent 5, the piles most likely to be in the active wetted channel, will be driven with a vibratory hammer until refusal and then driven to tip with an impact hammer.

In addition to these measures, NMFS recommends that Caltrans and its contractors implement the other measures discussed during the February 15, 2006 meeting at the project site, including:

1) the safe collection and relocation of all fish in small, backwatered channels in the immediate vicinity of the existing bridge and site of the temporary trestle.

2) further exclusion and/or the safe removal of fishes from those channels or newly formed backwatered areas during the period of construction.

3) implementation of Caltrans' best management practices to reduce impacts to aquatic environments including, but not limited to, operations that minimize the footprint of the project site with special effort made to avoid unnecessary impacts to riparian vegetation, stream bank stability, and water pollution from all machinery and project activities.

Consultation with NOAA Fisheries is ongoing.

2. Project Description

Route 128 in Sonoma County is a two-lane conventional highway connecting Sonoma and Napa Counties. It crosses the Russian River east of Geyserville on a 1932 steel pony truss bridge, 973.5' long, and is the only crossing of the river between Lytton Station Road/Alexander Valley Road, in Healdsburg, and Crocker Road, in Cloverdale. Pier 2(earlier documentation referred to Pier 2 as Pier 6) of the bridge was damaged by floodwaters during the New Years Eve/Day storm of 2005/2006. The damage consisted of the through and through cracking of the pier cap and web wall of Pier 2, the rotation of the pier in the downstream direction, and the dropping of the bridge spans, being supported by Pier 2, approximately 9 inches. The bridge is now closed to vehicular traffic, and all traffic is detoured to the Lytton Station Road exit (to the south) adding approximately 20 miles to the drive.

Caltrans proposes to construct a temporary trestle on the upstream side of the damaged bridge. The purpose of this trestle is two fold: 1) to allow the stabilization of Pier 2 prior to its demolition; and 2) provide access to the work site during the construction of the new bridge. The trestle will span the river and will be approximately 1000 feet long and up to 50 feet wide. The trestle will be installed during March of 2006 and will be removed prior to November of 2007. The temporary trestle will be supported on 24" steel pipe piles, for its entire length except in the wetted channel where 12" steel pipe piles will be used (if necessary). If it is necessary to install 24" steel pipe piles in the active river, an isolation pile will be installed, dewatered and then the 24" pile will be driven. Construction of this temporary trestle will begin in March 2006 and is expected to be completed by the end of May. The trestle will be constructed in 2 phases. Phase 1 will be the first 250 feet of trestle, begins at the upstream side of the western bank. This section of trestle will be used for the stabilization of Pier 2. After the completion of Phase 1 of the trestle construction, Pier 2 will be stabilized by the installation of 24" steel pipe piles at each of the pier corners. Superstructure will then be installed to support the bridge roadway via the temporary 24" steel pipe piles. Phase 2 will complete the trestle to the eastern side of the river. Once the trestle has reached the eastern flood terrace/bench, an access ramp will be constructed to touchdown. The trestle will be constructed to be able to support any necessary pile driving equipment or cranes necessary to construct the new bridge. Access roads to the trestle will connect to the existing highway outside of the zone of new bridge construction. Construction access roads on the river bed/gravel bar will also be used to facilitate and expedite the work.

Piles for the trestle and stabilization of Pier 2 will be installed through the river gravel bar to avoid impact to salmonids in the active stream channel. It may be necessary to relocate some of the existing gravel material to accomplish this work. At no time will the river flow be blocked. This will allow for the continual movement of salmonids and other fish to migrate through the work zone. This will also allow for the continued use of the river by boaters, primarily kayakers and canoeists. This recreational use will be maintained throughout the period of construction except during the placement of the pre-cast concrete girders of the new bridge.

During the demolition phase of the project, after Pier 2 is stabilized, work would be done from the newly constructed trestle. This demolition work will entail the removal of several of the concrete deck slabs and some of the steel support structures prior to the removal of an individual pony truss section. This early work is necessary to reduce the amount of weight that the crane will have to lift. No demolition material will be allowed to fall into/onto the river or river bed. Demolition is scheduled to begin in March of 2006 and is expected to be completed by the end of April. Existing fir piles 25' long, which are supporting the existing piers, will be removed to an estimated depth of 3 feet below the bottom of the existing footing or as directed by the Resident Engineer. Removal to this depth is anticipated to reduce the risk of the piles being exposed in the future. Removal of any hazardous material, such as lead paint and asbestos, associated with the demolition of the bridge will be addressed in the Special Specification Provisions.

Prior to any demolition work over the dry river bed, material will be placed below the area of work to catch and contain any debris that may fall from the bridge. Over the wetted channel, material will be suspended below the bridge to catch any falling material.

In order to lighten the load that the crane must lift, portions of the concrete deck will be removed. This will be done by saw cutting the concrete and then removing these saw cut portions. After the deck is saw cut and removed, several of the steel stringers, which supported the deck, will be removed to further lighten the load. Once it is determined that the pony truss span is light enough to be lifted, it will be 'unbolted' from the piers and lifted, by crane, and placed on the temporary trestle to be further demolished and trucked offsite.

After the deck and the pony trusses are removed, the concrete piers will be demolished. This will, in all likelihood, be done with a hoe-ram. A hoe-ram is device attached to an excavator that is specifically designed to fracture concrete and rock so that it can be removed. Once the concrete pier-cap, -web wall, and –footing are removed, and the concrete hauled off site, the existing 25' long fir piles, which support the existing piers, will be removed to an estimated depth of 3 feet below the existing pier footing or as directed by the Resident Engineer. Removal to this depth is anticipated to reduce the risk of the piles being exposed in the future.

Piers that remain in the wetted channel of the river will only be removed during the period of June15 to October 15 to minimize the impact to any fish that may be in the river at this location.

Depending on new bridge construction sequencing, and the availability of materials, the new bridge will be constructed as the old bridge is demolished. The new bridge construction is scheduled to begin on or about April 1, 2006. This early work will likely occur in the abutment areas of the bridge which are outside of the active river channel.

Construction of the new bridge will require the installation of new large diameter pipe piles to support the superstructure and bridge deck. These pipe piles will be 48" in diameter and will require two piles per pier. These piles will be driven to a depth at which there is sufficient skin friction to support the new bridge, estimated to be up to 150 feet. These piles/columns will be considered to be Cast In Steel Shell (CISS). After the CISS are driven to tip, they will be mucked out to allow for the placement of steel rebar cages and concrete. Some of the mucked material will be used to fill in the depressions left over from the removal of the old piers while the rest of the material will be placed on the river gravel bar. Geotechnical borings have shown that there is sand and gravel to depths greater than 100' in the locations of the new piers. The use of 48" piles will result in approximately 650 cubic yards of material removed from the piles.
The new bridge will be approximately 51' wide consisting of 2 12' traveled ways, 2 8' shoulders, a 5' wide sidewalk (only on the southern side of the bridge) and a 2' wide positive barrier between the southern shoulder and the sidewalk. There will also be 2 2' wide bridge rails on the outside of the new bridge.

The new bridge will be constructed of pre-cast box girders approximately 100' long. This will allow for a spacing of approximately 100' between the bents reducing the impact to the river from the piles.

An unnamed creek on the USGS Geyserville Quad sheet, commonly know as Plug Creek, is located in the south eastern quadrant of the project. Construction of the new bridge and its approach fills will necessitate placing approximately 100 feet of Plug Creek into a culvert prior to discharging it to the Russian River. The culvert will be 78" steel spiral rib culvert and will include rock slope protection at the outfall to dissipate the water energy prior to entering the Russian River. Plug Creek is an intermittent stream whose outfall is approximately 10' above the normal water surface elevation of the Russian River and does not have a fish population.

The construction zone is estimated to be approximately 220' wide, 110' on each side of the center line of the existing road extending approximately 300' past both the existing east and west abutments. The construction area, based on these estimates, will encompass about 8 acres. Approximately 2.5 acres of these 8 acres are within the banks of the Russian River. The remaining 5.5 acres is upland area. Some of this upland area will only be ‘aerial’ encroachments and will not involve any on-the-ground disturbance.

Proposed micro-tunneling for PG&E gas line 30’ under river bed is not subject to DFG 1602, ACOE 404 due to distance under river bed and distance from top of bank on east and west sides of river. Caltrans will work with the State Water Resources Control Board to obtain a Small Linear Underground Project General Permit for the micro-tunneling of the gas line.

River bed access will be from the western downstream side of the bridge. The area that is available for access will be delimited by high visibility fencing. No vehicle storage, fueling, or swamping will be allowed on the river bed. No vehicles are allowed in the active wetted river channel.

Equipment and material storage areas for construction is expected to be on the existing roadway approximately 300 feet behind the existing east and west bridge abutments and 110 feet on either side of the existing centerline. Other areas for storage will be inside the construction zone.

3. Federal Endangered or Threatened Species

The following species are known to occur in the vicinity of the project: the endangered Central California Coast Coho salmon (*Oncorhynchus kisutch*), the threatened Central California Coastal steelhead (*O. mykiss*), the threatened Central Valley steelhead (*O. mykiss*), and the California coastal chinook salmon (*O. tshawytscha*). See attached USFWS list.

HISTORY

Following are descriptions of the general life histories and population trends of listed species that may be directly or indirectly affected by the Project. The following information was extracted from the “Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-66, 598 p..

Central California Coast Coho Salmon (*Oncorhynchus kisutch*)

The Central California Coast coho salmon ESU extends from Punta Gorda in northern California south to and including the San Lorenzo River in central California (Weitkamp et al. 1995). The status of coho salmon throughout their West Coast range, including the Central California Coast coho salmon ESU, was formally assessed in 1995 (Weitkamp et al. 1995). NFMS published two subsequent status review updates with information pertaining to the Central California Coast coho salmon ESU in 1996 (NMFS 1996b, 1996d). Analyses from those reviews regarding extinction risk, risk factors, and hatchery influences are summarized in the following sections.

Status Indicators and Major Risk Factors

Data on abundance and population trends of coho salmon within the Central California Coast coho salmon ESU were limited. Historical time series of spawner abundance for individual river systems were unavailable. Brown et al. (1994) presented several historical point estimates of coho salmon spawner abundance (excluding ocean catch) for the entire state of California for 1940 and for various rivers and regions in the early 1960s and mid-1980s. Coho salmon were estimated to number between 200,000 and 500,000 statewide in the 1940s.54 Coho salmon spawning escapement was estimated to have declined to about 99,400 fish by the mid-1960s, with approximately 56,100 (56%) originating from streams within the Central California Coast coho salmon ESU. In the mid-1980s, spawning escapement was estimated to have dropped to approximately 30,480 in California and 18,050 (59%) within the Central California Coast coho salmon ESU. Employing the “20-fish rule” (see status review update for Southern Oregon/Northern California Coast coho salmon ESU for details), Brown et al. (1994) estimated wild and naturalized coho salmon populations at 6,160 (47% of the statewide total) for the Central California Coast coho salmon ESU during the late 1980s. All of these estimates are considered to be “best guesses” based on a combination of limited catch statistics, hatchery records, and personal observations of local biologists (Brown et al. 1994).

Further information regarding status was obtained from Brown et al.’s (1994) analysis of recent (1987–1991) occurrence of coho salmon in streams historically known to support populations. Of 133 historical coho salmon streams in the Central California Coast coho salmon ESU for which recent data were available, 62 (47%) were determined to still support coho runs while 71 (53%) apparently no longer support coho salmon. A subsequent analysis of surveys from 1995 to 1996 found a somewhat higher percentage (57%) of occupied streams (NMFS 1996b).

Nehlsen et al. (1991) provided no specific information on individual coho salmon populations in their 1991 status review, but concluded that salmon stocks in small coastal streams north of San Francisco were at moderate risk of extinction and those in coastal streams south of San Francisco Bay were at high risk of extinction. A subsequent status review by the Humboldt Chapter of the American Fisheries Society (Higgins et al. 1992) found four populations (Pudding Creek, Garcia River, Gualala River, and Russian River) to be at high risk of extinction and five (Ten Mile, Noyo, Big, Navarro, and Albion rivers) as stocks of concern.

The BRT identified risk factors that included extremely low contemporary abundance compared to historical abundance, widespread local extinctions, clear downward trends in abundance, extensive habitat degradation, and associated decreases in carrying capacity. The BRT concluded that in the Central California Coast ESU that hatcheries have heavily influenced the main stocks of coho salmon and that relatively few native coho salmon were left (Weitkamp et al. 1995). Most existing stocks have a history of hatchery planting, with many out-of-ESU stock transfers. A subsequent status review (NMFS 1996a), which focused on existing hatcheries, concluded that, despite the historical introduction of nonnative fish, the Scott Creek (Kingfisher Flat) and Noyo River broodstocks have regularly incorporated wild broodstock, and thus were unlikely to differ from naturally spawning fish within the ESU. Recent droughts and unfavorable ocean conditions were identified as natural factors contributing to reduced run size.

Previous BRT Conclusions

Based on the data presented above, the BRT concluded that all coho salmon stocks in the Central California Coast coho salmon ESU are depressed relative to historical abundance, and that most extant populations have been heavily influenced by hatchery operations. They unanimously concluded that natural populations of coho salmon in this ESU are in danger of extinction (Weitkamp et al. 1995). After considering new information on coho salmon presence within the ESU, the majority of the BRT concluded that the ESU is in danger of extinction, while a minority concluded the ESU is not presently in danger of extinction but is likely to become so in the foreseeable future (NMFS 1996b).

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New Data and Updated Analyses

Significant new information on recent abundance and distribution of coho salmon within the Central California Coast ESU has become available, much of which was summarized in two recent status reviews (NMFS 2001b; CDFG 2002c). Most of these data are of two types: 1) compilations of presence-absence information for coho salmon throughout the Central California Coast coho salmon ESU from 1987 to the present, and 2) new data on densities of juvenile coho salmon collected at a number of index reaches surveyed by private timber companies, the CDFG, and other researchers. Except for adult counts made at the Noyo Egg Collecting Station, which are both incomplete and strongly influenced by hatchery returns, there are no current time series of adult abundance within this ESU that span 8 years or more. Outmigrating smolts have been trapped at two trapping facilities in Caspar Creek and Little River since the mid-1980s; however, these are partial counts and only recently have mark-recapture studies been performed that allow correction for capture efficiency at these two sites. Thus, these smolt counts can only be considered indices of abundance.

Two analyses of presence-absence data were recently published. CDFG (2002c) focused on recent (1995–2001) presence of coho salmon in streams identified as historical producers of coho salmon by Brown and Moyle (1991). NMFS (2001b) published an updated status review of coho salmon presence in streams throughout the Central California Coast coho salmon ESU from 1989 to 2000. Scientists at the NMFS Southwest Fisheries Science Center continued to compile data on coho salmon presence-absence, which were incorporated into a database summarized by broodyear (rather than year of sampling) and covers broodyears 1986–2001. Data from CDFG's 2001 field survey of the Brown and Moyle (1991) streams were incorporated into this database. Analyses in this status review update supersede those in NMFS (2001b).

CDFG Presence-Absence Analysis

Methods

Methods used by CDFG (2002c) to analyze presence-absence information in the Central California Coast coho salmon ESU differed from those used for the SONCC analysis. Analysis focused on results from CDFG's 2001 summer juvenile sampling effort, in which 135 of 173 streams identified by Brown and Moyle (1991) as historical coho salmon streams within the Central California Coast coho salmon ESU were sampled. Additionally, CDFG assumed coho salmon were present in any stream where their presence was detected during any 3 consecutive years during the period 1995–2001. An estimate of percent coho salmon presence was calculated by totaling the number of streams for which presence was either observed or assumed, and dividing by the total number of streams surveyed, including those where presence was assumed. No formal statistical analysis of trends was performed because of the lack of comparable data from previous time periods.

Results

For the Central California Coast coho salmon ESU as a whole, CDFG (2002c) estimated that coho salmon were present in 42% of streams historically known to contain coho salmon. Estimated occupancy was highest in Mendocino County (62%), followed by Marin County (40%), Sonoma County (4%), and San Francisco Bay tributaries (0%). Because of differences in the specific streams considered and methods for estimating occupancy rates, these numbers are not directly comparable with those derived by Brown et al. (1994). Nevertheless, the regional and overall ESU patterns are generally concordant for the two studies, indicating substantial variation in occupancy rates across the ESU, with lower occupancy rates in the southern portion of the ESU.

NMFS Presence-Absence Analysis

Methods

Scientists at NMFS's Southwest Fisheries Science Center compiled survey information from streams with historical or recent evidence of coho salmon presence within the Central California Coast coho salmon ESU. Data were provided primarily by the CDFG, private landowners, consultants, academic researchers, and others who conducted sampling within the Central California Coast coho salmon ESU from 1988 to 2002. The majority of data came from summer juvenile surveys, though information from downstream migrant trapping and adult spawner surveys was also included. Observations of presence or absence for a particular stream were assigned to the appropriate broodyear based on life stages observed (or expected, in the case of absences). The resulting data set spans broodyears 1987 to 2001, though data from the 2002 summer field season (broodyear 2001) were not fully reported when the analysis was performed.

Results for NMFS's presence-absence analysis are presented by major watersheds or aggregations of adjacent watersheds. Results from larger watersheds are typically presented independently, whereas data from contiguous smaller coastal streams, where data were relatively sparse, are grouped together. In a few cases, individual smaller coastal streams with only a few observations were aggregated with adjacent larger streams if there was no logical geographic grouping of smaller streams.

Results

The estimated percentage of streams in which coho salmon were detected shows a general downward trend from 1987 to 2000, followed by a substantial increase in 2001. Several caveats, however, warrant discussion. First, the number of streams surveyed per year also shows a general increase from 1987 to 2000; thus, there may be a confounding influence of sampling size if sites surveyed in the first half of the time period are skewed disproportionately toward observations in streams where presence was more likely. Second, sample size from broodyear 2001 was relatively small and the data were weighted heavily toward certain geographic areas (Mendocino County and systems south of the Russian River). The data for broodyear 2001 included almost no observations from watersheds from the Navarro River to the Russian River, or tributaries to San Francisco Bay, areas where coho salmon have been scarce or absent in recent years. Thus, although 2001 appears to have been a relatively strong year for coho salmon in the Central California Coast ESU as a whole, the high percentage of streams where presence was detected that is shown in Figure 207 is likely inflated.

Two other patterns were noteworthy. First, compared with percent presence values for the SONCC ESU, values in the Central California Coast coho salmon ESU were more highly variable and showed a somewhat more cyclical pattern. In general, percent occupancy was relatively low in broodyears 1990, 1993, 1996, and 1999, suggesting that this brood lineage is in the poorest condition. In contrast, during the 1990s, percent occupancy tended to be high in broodyears 1992, 1995, 1998, and 2001, suggesting that this is the strongest brood lineage of the three. Second, there is a general tendency for percent occupancy to be slightly higher (2–15%) for the Brown and Moyle streams compared with the ESU as a whole. We speculate that this pattern may reflect the fact that increased concern over Central California Coast coho salmon in the mid-1990s prompted increased stream sampling, including streams other than those traditionally known to support coho salmon. Lower occupancy rates at these sites might be expected if they represent habitats that are generally less suitable for coho salmon.

When data are aggregated over brood cycles (3-year periods), the percentage of streams with coho salmon detected shows a similar downward trend, from 72% in 1987–1989, to 62% in 1990–1992, to less than 55% in the last three brood cycles. Again there are confounding influences of increased sampling fraction through time and incomplete reporting for the 2001 broodyear. Nevertheless, it appears that the percent of historical streams occupied continued to decline from the late 1980s to the mid-1990s and remains below 50% for the ESU as a whole. Additionally, coho salmon appear to be extinct or nearing extinction in several geographic areas including the Garcia River, the Gualala River, the Russian River, and San Francisco Bay tributaries. There is also evidence that some populations that still persist in the southern portion of the range, including Waddell and Gazos creeks, have lost one or more brood lineages (Smith 2001a).

Results from our presence-absence analysis are generally concordant with CDFG's analysis. The two studies show consistent regional patterns suggesting that within the Central California Coast coho salmon ESU the proportion of streams occupied is highest in Mendocino County, but that populations in streams in the southern portion of the range (excluding portions of Marin County) have suffered substantial reductions in range. NMFS analysis is more suggestive of a continued decline in percent occupancy from the late 1980s to the present; however, increased sampling in recent years may be confounding any trends.

Adult Time Series

No time series of adult abundance free of hatchery influence and spanning 8 or more years are available for the Central California Coast coho salmon ESU. Adult counts from the Noyo Egg Collecting Station (ECS) dating back to 1962 represent a mixture of naturally produced and hatchery fish, and counts are incomplete most years because trap operation was sporadic during the season and typically ceased after broodstock needs were met. Thus, at best they represent an index of abundance. Assuming that these counts reflect general population trends, there appears to have been a significant decline in abundance of coho salmon in the South Fork Noyo River beginning in 1977. No formal analysis of trends was conducted because of the uncertainty of the relationship between catch statistics and population size, as well as the relative contribution of hatchery fish to total numbers during the entire period of record.

Smolt Time Series

CDFG personnel have trapped outmigrating smolts at Caspar Creek and Little River since 1986. These counts are partial counts, uncorrected for capture efficiency. As such, they provide only indices of abundance. However, they likely capture gross changes in smolt abundance over the years. For Caspar Creek, the highest smolt counts occurred in the late 1980s and early 1990's, decreased in the mid-1990s, then increased in the past 3 years to levels approaching those of the late 1980s. For Little River, a similar pattern was observed from the late 1980s to the mid-1990s; however, only a slight increase in numbers was observed in the last 3 years of records. Smolt counts were higher in each year from 1986 to 1989 than in any year since. When individual brood lineages are tracked, Little River shows a decline in all three brood lineages over the period of record. In contrast, Caspar Creek shows a decline in the 1987 brood lineage, relatively consistent numbers in the 1988 brood lineage, and a decrease in the early to mid-1990s followed by an increase over the last two brood cycles to levels comparable to those observed in 1989. For both locations, the estimated long-term trend is negative but not significantly different from 0. Likewise, λ values are not significantly different from 1.

Juvenile Time Series

Methods

Although recent estimates of adult and smolt abundance are scarce for the Central California Coast coho salmon ESU, estimates (or indices) of juvenile density during summer were made at more than 50 index sites in the past 8 to 18 years. Methods for analyzing these data are described in detail in Section 28. Briefly, data from individual sampling sites were natural log-transformed and normalized to prevent spurious trends arising from different data collection methods or reporting units. Data were then grouped into units thought to represent plausible independent populations based on watershed structure. Trends were then estimated for putative populations by estimating the slope (and associated 95% confidence intervals) for the aggregated data. Analysis was restricted to: 1) sites where a minimum of 6 years of data were available, and 2) putative populations where more than 65% of all observations were nonzero values.

Nine geographic areas (putative populations) were represented in the aggregated data, including Pudding Creek, Noyo River, Caspar Creek, Big River, Little River, Big Salmon Creek, Lagunitas Creek, Redwood Creek, and coastal streams south of San Francisco Bay, including Waddell, Scott, and Gazos creeks. Spatially, these sites cover much of the Central California Coast coho salmon ESU; however, several key watersheds are not represented, including the Ten Mile, Navarro, Garcia, Gualala, and Russian rivers. Although considerable sampling has been done in the Ten Mile River basin, the high proportion of zero values precluded analysis of these data.

RESULTS

Overall, analysis of juvenile data provided little evidence of either positive or negative trends for the putative populations examined. Estimated slopes were negative for six populations and positive for three; however, none of the estimated slopes differed significantly from zero.

New Hatchery Information

The BRT (Weitkamp et al. 1995) identified four production facilities that had recently produced for release in the Central California Coast coho salmon ESU: the Noyo Egg Collecting Station (reared at Mad River Hatchery) and Don Clausen (Warm Springs) hatchery, both operated by CDFG; Big Creek Hatchery (Kingfisher Flat Hatchery), operated by the Monterey Bay Salmon and Trout Program; and the Silver-King ocean ranching operation. The latter facility closed in the late 1980s.

Noyo Egg Collecting Station

The Noyo Egg Collecting Station (ECS), located on the South Fork Noyo River approximately 17 km inland of Fort Bragg, began operating in 1961 and has collected coho salmon in all but a few years since that time. Fish have historically been reared at the Mad River Hatchery, Don Clausen (Warm Springs) Hatchery, and the Silverado Fish Transfer Station. There are no records of broodstock from other locations being propagated with Noyo fish for release back into the Noyo

River system, but a few out-of-ESU transfers directly into the Noyo River system have been recorded, including Alsea and Klaskanine, Oregon, stocks (SSHAG 2003).

Average annual release of coho salmon yearlings was 108,000 from 1987 to 1991 (Weitkamp et al. 1995), declined to about 52,000 between 1992 and 1996, then increased again to about 72,000 fish between 1997 and 2002, inclusive of 2 years during which no yearlings were released. Releases were made exclusively to the ECS or elsewhere in the South Fork Noyo River drainage in the past decade. Between 1991 and 2001, adult returns averaged 572 individuals, though these represent incomplete counts in most years, as counting typically ceased after broodstock needs were met (Grass 2002). On average, 91 females were spawned annually during this 11-year period (Grass 1992, 1993, 1995a, 1995b, 1996, 1997, 1998, 1999, 2000, 2001, 2002).

There are no basinwide estimates of natural and artificial production for the Noyo River basin as a whole; however, marking of coho salmon juveniles released from the Noyo ECS on the South Fork Noyo River began in 1997, and returns have been monitored since the 1998–1999 spawning season. In the 1998, 1999, and 2000 broodyears, marked hatchery fish constituted 85%, 70%, and 80%, respectively, of returning adults captured at the ECS.

The BRT (NMFS 1996a) concluded that, although exotic stocks have occasionally been introduced into the Noyo system, the regular incorporation of local natural fish into the hatchery population made the likelihood that this population differs substantially from naturally spawning fish in the ESU low; therefore, the BRT included them in the ESU. Because Central California Coast coho salmon were listed, no significant changes in hatchery practices have occurred. The Noyo ECS operation has been classified as a category 1 hatchery (SSHAG 2003).

Don Clausen (Warm Springs) Hatchery

The Don Clausen Hatchery (also known as Warm Springs stock), located on Dry Creek in the Russian River system 72 km upstream of the mouth, began operating in 1980. Initial broodstock used were from the Noyo River system, and Noyo fish were planted heavily from 1981 to 1996.

Average annual releases of coho salmon from the hatchery decreased from just over 123,000 in the 1987–1991 period to about 57,000 in the years between 1992 and 1996, and Noyo River broodstock continued to constitute about 30% of the releases during the latter period. Production of coho salmon at the facility ceased entirely after 1996. Adult returns averaged 245 fish between 1991 and 1996, but following the cessation of releases, no more than four coho salmon have been trapped at the hatchery in any subsequent year.

Because the Warm Springs population was originally derived from Noyo River stock and continued to receive transfers from the Noyo system throughout its operation, the BRT concluded that the hatchery population was not a part of the ESU.

Beginning in 2001, however, a captive broodstock program was initiated at the Don Clausen facility. A total of 337 juveniles were electro-fished from Green Valley and Mark West Springs creeks, two Russian River tributaries that still appear to support coho salmon, as well as Olema Creek, a tributary to Lagunitas Creek. Specific mating protocols for these fish have not yet been determined. The captive broodstock program proposes to eventually release 50,000 fingerlings and 50,000 yearlings into five Russian River tributaries. Under the captive broodstock program, the Don Clausen Hatchery has been classified as a category 1 hatchery (SSHAG 2003).

Kingfisher Flat (Big Creek) Hatchery

The Monterey Bay Salmon and Trout Project (MBSTP) has operated Kingfisher Flat Hatchery, located on Big Creek, a tributary to Scott Creek, since 1976. The facility is near the site of the former Big Creek Hatchery, which was operated from 1927 to 1942, when a flood destroyed the facility. An additional facility in Santa Cruz County, the Brookdale Hatchery on the San Lorenzo River, operated from 1905 to 1953. Both the Big Creek and Brookdale hatcheries were supplied with eggs taken at an egg-collection facility located on Scott Creek; additional eggs were provided from other hatcheries around the state. Production of coho salmon at both hatcheries was sporadic. There is evidence that coho salmon eggs from Baker Hatchery (Birdsview Station) in Washington State were transferred to Brookdale Hatchery in 1906–1910. Although records documenting where these fish were distributed are unavailable, it is possible that some were released into Scott Creek. In subsequent years, releases from both facilities back into Scott Creek included both Scott Creek fish (1913, 1915, 1929, 1930, 1934, and 1936–1939), as well as fish from Fort Seward, Mendocino County (1932), and Prairie Creek, Humboldt County (1933, 1935, and 1939). Throughout these years, only fry were (generally during July through September) and numbers of fish were relatively small. In the 10 years between 1929 and 1939, during which coho salmon were planted in Scott Creek, the total fry release averaged about 34,000 fish. During the Silver-King operation, broodstock was obtained from Oregon, Washington, British Columbia, and Alaska.

Since 1976, when MBSTP began operating the Kingfisher Flat Hatchery, only local broodstock have been released back into Scott Creek. Some Noyo, Prairie Creek, and San Lorenzo coho salmon were reared at the hatchery in the early 1990s, but were released into the San Lorenzo River rather than Scott Creek. Mating protocols at the hatchery follow a priority scheme in which wild broodstock are used in years of relatively high abundance, wild-hatchery crosses are done when wild fish are less available, and hatchery-hatchery crosses are made when wild fish are unavailable. Under the current management plan, up to 30 females and 45 males can be taken with the restriction that the first 10 spawning pairs observed must be allowed to spawn undisturbed in their natural habitat, and then only 1 in 4 females may be taken to spawn. In recent years, few or no fish have been taken, due to low abundance; however, in 2001, 123 coho were observed and 26 “wild” females were taken for spawning. Of the 123 coho observed, 40% were marked hatchery fish. No other data are available to assess the relative contribution of hatchery versus naturally produced coho salmon.

In its 1996 coho status review update, the BRT concluded that the Kingfisher Flat (Scott Creek) hatchery population should be considered part of the ESU and was essential for ESU recovery (NMFS 1996a). This conclusion was based on the fact that local broodstock was regularly incorporated into the hatchery population in the years that coho were produced between 1905 and 1943, and there have been no out-of-basin or out-of-ESU transfers since the hatchery was restarted in 1976. The MBSTP operation is classified as a category 1 hatchery (SSHAG 2003). A captive broodstock program for Scott Creek was initiated at the NMFS Santa Cruz Laboratory in 2003.

SUMMARY

Artificial Propagation

Artificial propagation of coho salmon within the Central California Coast coho salmon ESU has been reduced since it was listed in 1996. The Don Clausen Hatchery ceased production of coho salmon, and releases from the Noyo ECS operation declined over the past 6 years, in part because coho were not produced during 2 of those 6 years. The Monterey Bay Salmon and Trout Program produced few coho salmon for release in the last 6 years due to low adult returns to Scott Creek. Genetic risks associated with out-of-basin transfers appear minimal. However, potential genetic modification in hatchery stocks resulting from domestication selection or low effective population size remains a concern.

Harvest Impacts

Harvest of Central California Coast–origin coho salmon historically occurred in coho- and Chinook-directed commercial and recreational fisheries off the coast of California. Coho landing information for various ports in California is available dating back to the 1950s for commercial harvest and the early 1960s for recreational harvest; however, there are no historical estimates of either harvest or exploitation rates specific to Central California Coast coho salmon. Likewise, no direct information is available about the ocean distribution of coho salmon; however, it is likely that most Central California Coast–origin coho salmon remain in waters off California and southern Oregon. Thus, harvest management within this region is most relevant for evaluating harvest impacts.

Through the mid-1980s, the season for directed commercial harvest of coho salmon typically lasted 3 to almost 5 months throughout California. In the late 1980s and early 1990s, the commercial salmon seasons throughout California were generally shorter, particular in the region south of Point Delgada. By 1992, the commercial coho salmon season was closed completely from the Oregon border south to Horse Mountain, California, and open only 7 days from Point Arena to San Pedro. Retention of coho salmon by commercial fishers south of Cape Falcon, Oregon, including all of California, has been prohibited since 1993 (PFMC 2002b). Likewise, retention of coho salmon in recreational fisheries was prohibited in 1994 from Cape Falcon, Oregon, south to Horse Mountain, California. This prohibition was extended to include all California waters in 1996 (PFMC 2003b). Nonretention regulations in both commercial and recreational fisheries remain in place throughout coastal California and southern Oregon, but selective fishing for marked hatchery coho salmon has been allowed north of Humbug Mountain, Oregon, since 1999, and some incidental mortality of Central California Coast coho salmon may occur in this fishery. Additionally, coho salmon are also incidentally caught or hooked in Chinook salmon fisheries off California.

Although no estimates of incidental mortality associated with Chinook salmon fisheries are available (PFMC 2003b), nonretention regulations undoubtedly have resulted in a substantial reduction in harvest-related mortality since 1993. The PFMC (2003b) estimates that statewide commercial harvest of coho salmon averaged about 163,000 fish between 1952 and 1991; since 1992 there have been no known landings of coho salmon. Ocean recreational harvest of coho salmon averaged about 34,000 fish from 1962 to 1993. Total estimated incidental and illegal harvest of coho salmon has not exceeded 1,000 fish in any year since nonretention regulations were put in place.

There is no legal inside harvest of coho salmon within the Central California Coast coho salmon ESU; any fishery mortality results from incidental catch-and-release hooking mortality in other fisheries. There are no estimates of inside harvest or mortality of coho salmon in the Central California Coast coho salmon ESU (PFMC 2003b); however, CDFG (2003b) considers the potential for significant incidental mortality (and poaching) to be low because of the minimal overlap between the coho migration season and the steelhead season (CDFG 2003b).

Comparison with Previous Data

New data for the Central California Coast coho salmon ESU includes expansion of presence-absence analyses, an analysis of juvenile abundance in 13 river basins, smolt counts from two streams in the central portion of the ESU, and one adult time series for a population with mixed wild and hatchery fish. The presence-absence analysis suggests possible continued decline of coho salmon between the late 1980s and the late 1990s, a pattern that is mirrored in the limited smolt and adult counts. Juvenile time series suggest no obvious recent change in status, but most observations underlying that analysis were made in the period from 1993 to 2002. Coho salmon populations continue to be depressed relative to historical numbers, and strong indications show that breeding groups have been lost from a significant percentage of streams within their historical range. A number of coho populations in the southern portion of the range appear to be either extinct or nearly so, including those in the Gualala, Garcia, and Russian rivers, as well as smaller coastal streams in and south of San Francisco Bay. Although the 2001 broodyear appeared to be relatively strong, data were not yet available from many of the most at-risk populations within the Central California Coast coho salmon.

No new information has been provided that suggests additional risks beyond those identified in previous status reviews. Termination of hatchery production at the Don Clausen (Warm Springs) Hatchery and reductions in production at the Noyo and Kingfisher Flat (Big Creek) facilities suggest a decrease in potential risks associated with hatcheries; however, the lack of substantive information regarding the relative contribution of hatchery and naturally produced fish at these facilities adds uncertainty as to the potential risks these operations may pose to the genetic integrity of the Noyo River and Scott Creek stocks. Restrictions on recreational and commercial harvest of coho salmon since 1993–1994 have substantially reduced the exploitation rate on Central California Coast coho salmon.

Central Valley steelhead (*Oncorhynchus mykiss*)

Central Valley steelhead (*O. mykiss*) is listed as threatened under the ESA (March 19, 1998, 63 FR 13347). This ESU consists of steelhead populations in the Sacramento and San Joaquin River basins in California's Central Valley. Designated critical habitat for Central Valley steelhead includes all river reaches accessible to listed steelhead in the Sacramento and San Joaquin rivers and their tributaries in California, except for reaches on tribal lands. Also included are river reaches and estuarine areas of the Sacramento-San Joaquin Delta, all waters from Chipps Island westward to Carquinez Bridge, including Honker Bay, Grizzly Bay, Suisun Bay, and Carquinez Strait, all waters of San Pablo Bay westward of the Carquinez Bridge, and all waters of San Francisco Bay (north of the San Francisco/Oakland Bay Bridge) from San Pablo Bay to the Golden Gate Bridge. Excluded are: (1) areas above specific dams identified in the Federal Register notice; (2) areas above longstanding, natural impassable barriers (i.e., natural waterfalls in existence for at least several hundred years); (3) Indian tribal lands; and (4) areas of the San Joaquin River upstream of the Merced River confluence (February 16, 2000, 65 FR 7764).

Steelhead can be divided into two basic reproductive ecotypes, based on the state of sexual maturity at the time of river entry and duration of spawning migration (Burgner et al. 1992). The stream-maturing type (summer-run steelhead in the Pacific Northwest and northern California) enters freshwater in a sexually immature condition between May and October and requires several months to mature and spawn. The ocean-maturing type (winter-run steelhead in the Pacific Northwest and northern California) enters freshwater between November and April, with well-developed gonads, and spawns shortly thereafter. In basins with both summer and winter steelhead runs, the summer run appears to occur where habitat is not fully used by the winter run or where a seasonal hydrologic barrier, such as a waterfall, separates them. Summerrun steelhead usually spawn farther upstream than winter-run steelhead (Withler 1966, Roelofs 1983, Behnke 1992). Coastal streams are dominated by winter-run steelhead, whereas inland steelhead of the Columbia River basin are almost exclusively summer-run steelhead. Winter-run steelhead may have been excluded from inland areas of the Columbia River basin by Celilo Falls or by the considerable migration distance from the ocean. The Sacramento–San Joaquin River basin may have historically had multiple runs of steelhead, which probably included both ocean-and stream-maturing stocks (CDFG 1995, McEwan and Jackson 1996). These steelhead are referred to as winter-run steelhead by the California Department of Fish and Game (CDFG); however, some biologists call them fall-run steelhead (Cramer et al. 1995).

Inland steelhead of the Columbia River basin, especially the Snake River subbasin, are commonly referred to as either A-run or B-run. These designations are based on a bimodal migration of adult steelhead at Bonneville Dam (235 km from the mouth of the Columbia River) and differences in age (1- versus 2-ocean) and adult size observed among Snake River steelhead. It is unclear, however, whether life history and body-size differences observed upstream are correlated back to the groups forming the bimodal migration observed at Bonneville Dam. Furthermore, the relationship between patterns observed at the dams and distribution of adults in spawning areas throughout the Snake River basin is not well understood. A-run steelhead are believed to occur throughout the steelhead-bearing streams of the Snake River basin and the inland Columbia River; B-run steelhead are thought to be produced only in the Clearwater, Middle Fork Salmon, and South Fork Salmon rivers (IDFG 1994).

The half-pounder is an immature steelhead that returns to freshwater after only 2 to 4 months in the ocean, generally overwinters in freshwater, then outmigrates again the following spring. Half-pounders are generally less than 400 mm and are reported only from the Rogue, Klamath, Mad, and Eel rivers of southern Oregon and northern California (Snyder 1925, Kesner and Barnhart 1972, Everest 1973, Barnhart 1986); however, it has been suggested that as mature steelhead, these fish may only spawn in the Rogue and Klamath river basins (Cramer et al. 1995). Various explanations for this unusual life history have been proposed, but there is still no consensus as to what, if any, advantage it affords to the steelhead of these rivers.

In May 1992, the Oregon Natural Resources Council (ONRC) and 10 co-petitioners petitioned NMFS to list Oregon's Illinois River winter-run steelhead (ONRC et al. 1992). NMFS concluded that Illinois River winter-run steelhead by themselves did not constitute an ESA "species" (Busby et al. 1993, NMFS 1993b). In February 1994, NMFS received a petition seeking protection under the ESA for 178 populations of steelhead (anadromous *O. mykiss*) in Washington, Idaho, Oregon, and California. At the time, NMFS was conducting a status review of coastal steelhead populations (*O. mykiss irideus*) in Washington, Oregon, and California. In response to the broader petition, NMFS expanded the ongoing status review to include inland steelhead (*O. mykiss gairdneri*) occurring east of the Cascade Mountains in Washington, Idaho, and Oregon.

In 1995, the steelhead BRT met to review the biology and ecology of West Coast steelhead. After considering available information on steelhead genetics, phylogeny, and life history; freshwater ichthyogeography; and environmental features that may affect steelhead, the BRT identified 15 ESUs—12 coastal forms and 3 inland forms. After considering available information on population abundance and other risk factors, the BRT concluded that 5 steelhead ESUs (Central California Coast, South-Central California Coast, Southern California, California Central Valley, and Upper Columbia River) were presently in danger of extinction, 5 steelhead ESUs (Lower Columbia River, Oregon Coast, Klamath Mountains Province, Northern California, and Snake River Basin) were likely to become endangered in the foreseeable future, 4 steelhead ESUs (Puget Sound, Olympic Peninsula, Southwest Washington, and Upper Willamette River) were not presently in significant danger of becoming extinct or endangered, although individual stocks within these ESUs may be at risk, and 1 steelhead ESU (Middle Columbia River) was not presently in danger of extinction but the BRT was unable to reach a conclusion as to its risk of becoming endangered in the foreseeable future.

Of the 15 steelhead ESUs identified by NMFS, 5 are not listed under the ESA: Southwest Washington, Olympic Peninsula, and Puget Sound (NMFS 1996a), Oregon Coast (NMFS 1998c), and Klamath Mountain Province (NMFS 2001c); 8 are listed as threatened: Snake River Basin, Central California Coast and South-Central California Coast (NMFS 1997b), Lower Columbia River, California Central Valley (NMFS 1998c), Upper Willamette River, Middle Columbia River (NMFS 1999b), and Northern California (NMFS 2000), and 2 are listed as endangered: Upper Columbia River and Southern California (NMFS 1997b).

The West Coast Steelhead BRT met in January, March, and April 2003 to discuss new data received and to determine whether the new information warranted any modification of the original BRT's conclusions. This report summarizes new information and the preliminary BRT conclusions on the following ESUs: Snake River Basin, Upper Columbia River, Middle Columbia River, Lower Columbia River, Upper Willamette River, Northern California, Central California Coast, South-Central California Coast, Southern California, and California Central Valley.

Central California Coast Steelhead (*Oncorhynchus mykiss*)

The Central California Coast steelhead ESU was determined to inhabit coastal basins from the Russian River (Sonoma County) to Soquel Creek (Santa Cruz County) inclusive (Busby et al. 1996). Also included in this ESU are populations inhabiting tributaries of San Francisco and San Pablo bays (though there is some uncertainty about the latter). The ESU is composed only of winter-run fish.

Risks and limiting factors

Busby et al. (1996) reported two significant habitat blockages: the Coyote and Warm Springs dams in the Russian River watershed. Data indicated that other smaller fish passage problems were widespread in the geographic range of the ESU. Other impacts noted in the status report were urbanization and poor land-use practices, catastrophic flooding in 1964 causing habitat degradation, and dewatering due to irrigation and diversion. The relative strengths of these various impacts has not been formally analyzed. Principal hatchery production in the region comes from the Warm Springs Hatchery on the Russian River and the Monterey Bay Salmon and Trout Project on a tributary of Scott Creek. At the time of the status review, other small private programs were producing steelhead in the range of the ESU and, as reported by Bryant (1994), were using stocks indigenous to the ESU, but not necessarily to the particular basin in which the program was located. There was no information on the actual contribution of hatchery fish to naturally spawning populations.

Status indicators

Busby et al. (1996) reported one estimate of historical (pre-1960s) abundance: Shapovalov and Taft (1954) described an average of about 500 adults in Waddell Creek (Santa Cruz County) for the 1930s and early 1940s. A bit more recently, Johnson (1964) estimated a run size of 20,000 steelhead in the San Lorenzo River before 1965, and CDFG (1965) estimated an average run size of 94,000 steelhead for the entire ESU, for the period 1959–1963 (see Table 55 for a breakdown of numbers by basin). The analysis by CDFG (1965) was compromised by the fact that, for many basins, the data did not exist for the full 5-year period of their analysis. The authors of CDFG (1965) state that "estimates given here which are based on little or no data should be used only in outlining the major and critical factors of the resource."

Recent data for the Russian and San Lorenzo rivers (Reavis 1991, CDFG 1994a, Shuman 1994; see Table 55) suggested that these basins had populations smaller than 15% of their size 30 years earlier. These two basins were thought to have originally contained the two largest steelhead populations in the Central California steelhead ESU.

A status review update in 1997 (NMFS 1997b) concluded that slight increases in abundance occurred in the 3 years following the status review. However, the analyses on which these conclusions were based had various problems, including inability to distinguish hatchery and wild fish, unjustified expansion factors, and variance in sampling efficiency on the San Lorenzo River. Presence-absence data compiled by P. Adams26 indicated that most (82%) sampled streams (a subset of all historical steelhead streams) had extant populations of juvenile *O. mykiss*.

Previous BRT Conclusions

The original BRT concluded that the ESU was in danger of extinction (Busby et al. 1996). The BRT considered extirpation especially likely in Santa Cruz County and in the tributaries to San Pablo and San Francisco bays. The BRT suggested that abundance in the Russian River (the largest system inhabited by the ESU) has declined sevenfold since the mid-1960s, but abundance appeared to be stable in smaller systems. Two major sources of uncertainty were 1) few data on run sizes, which necessitated that the listing be based on indirect evidence, such as habitat degradation; and 2) uncertainty regarding genetic heritage of populations in tributaries to San Francisco and San Pablo bays, causing uncertainty in the delineation of the geographic boundaries of the ESU. A status review update (NMFS 1997b) concluded that conditions had improved slightly, and that the ESU was not presently in danger of extinction but was likely to become so in the foreseeable future. (Minorities supported both more and less extreme views on extinction risk.) Uncertainties in the update mainly revolved around sampling efforts that were inadequate for detecting status or trends of populations inhabiting various basins.

The BRT formally assessed the status of steelhead in 1996 (Busby et al. 1996). NMFS updated the original status review in 1997 (NMFS 1997b) and listed the Central California Coast steelhead ESU as threatened in August 1997.

New Data and Updated Analyses

There are two significant sets of new information regarding status: 1) numerous reach-scale estimates of juvenile abundance have been made for populations of the ESU, and 2) harvest regulations have been substantially changed since the last status review. Analyses of this information are described below.

Juvenile Data

Data on juvenile abundance have been collected at a number of sites using a variety of methods (D. W. Alley & Associates 1994, 1995, 1997, 1998, 1999, 2000, 2002a, 2002b; Smith 1992, 1994a, 1994b, 1994c, 1996a, 1996b, 1996c, 1997, 1998a, 1998b, 1998c, 1999, 2000a, 2000b, 2001a, 2001b, 2002). Many of the methods involve the selection of reaches thought to be "typical" or "representative" steelhead habitat. In general, the field crew made electro-fishing counts (usually multiple-pass, depletion estimates) of the young-of-the-year and 1+ age classes. Most of the target reaches were sampled several years in a row; thus there are a large number of short time series. Although methods were always consistent within a time series, they were not necessarily consistent across time series.

Because there are so few adult data on which to base a risk assessment of this ESU, we chose to analyze these juvenile data. However, we note that they have limited usefulness for understanding the status of the adult population, due to nonrandom sampling of reaches within stream systems, nonrandom sampling of populations within the ESU, and a general lack of estimators shown to be robust for estimating fish density within a reach. In addition, even if more rigorous methods had been used, there is no simple relationship between juvenile numbers and adult numbers (Shea and Mangel 2001), the latter being the usual currency for status reviews.

To estimate a trend in the juvenile data, the data within each time series were log-transformed and then normalized, so that each datum represented a deviation from the mean of that specific time series. The normalization is intended to prevent spurious trends that could arise from the diverse set of methods used to collect the data. Then, the time series were grouped into units thought to plausibly represent independent populations; the grouping was based on watershed structure. Finally, within each population, a linear regression was done for the mean deviation versus year. The estimator for time trend within each grouping is the slope of the regression line. The minimum number of observations per time series is 6 years (other assessments in this status review place the cutoff at 10 years). The general lack of data on the Central California Coast steelhead ESU prompted us to consider these data despite the brevity of some series.

This procedure resulted in five independent populations for which a trend was estimated: the San Lorenzo River, Scott Creek, Waddell Creek, Gazos Creek, and Redwood Creek in Marin County. Only downward trends were observed in the five populations. The mean trend across all populations was significantly less than 0 ($H0$: slope > 0; $p < 0.022$ via one-tailed t-test against expected value). This outcome suggests an overall decline in juvenile abundance, but it is important to note that such a conclusion requires the assumptions that the assessed populations 1) are indeed independent populations rather than plausibly independent populations, and 2) were randomly sampled from all populations in the ESU (they are probably better regarded as having been haphazardly sampled).

Possible Changes in Harvest Impacts

Since the original status review of Busby et al. (1996), regulations concerning sport fishing have been changed in a way that probably reduces extinction risk for the ESU. The CDFG has prohibited sport harvest in the ocean (2002a), and ocean harvest is a rare event. For freshwaters (CDFG 2002b), all coastal streams are closed to fishing year round, except for special listed streams that allow catch-and-release angling or summer trout fishing. Catch-and-release angling with restricted timing (generally, winter season Sundays, Saturdays, Wednesdays, and holidays) is allowed in the lower main stems of many coastal streams south of San Francisco (Aptos Creek, Butano Creek, Pescadero Creek, San Gregorio Creek, San Lorenzo River, Scott Creek, Soquel Creek). Notably, for a while Waddell Creek in Santa Cruz County had a five-per-day bag limit during the winter, for the short reach between Highway 1 and the ocean. This bag limit was reduced to zero in the supplementary regulations issued in a separate document (CDFG 2002b). Catch-and-release is allowed year round, except April and May, in the lower parts of Salmon Creek in Sonoma County and Walker Creek in Marin County.

Russian Gulch in Sonoma County has similar regulations except that one hatchery fish may be taken in the winter. The Russian River is the largest system and probably originally supported the largest steelhead population in the Central California Coast steelhead ESU. The main stem is currently open all year and has a bag limit of two hatchery steelhead or trout. Above the confluence with the East Branch it is closed year round. Santa Rosa Creek and Laguna Santa Rosa, Sonoma County tributaries to the Russian River, have a summer catch-and-release fishery.

Tributaries to the San Francisco Bay system have less restricted fisheries. All streams in Alameda, Contra Costa, and Santa Clara counties (east and south bay) have summer fisheries with a bag limit of five, except for special cases that are closed all year (Mitchell Creek, Redwood Creek in Alameda County, San Francisquito Creek and tributaries, and Wildcat Creek). In the north Bay, the lower main stem of the Napa River has catch-and-release year round except April and May; there is a bag limit of one hatchery steelhead or trout. Upper Sonoma Creek and tributaries have a summer fishery with bag limit of five. Summer trout fishing is allowed in some lakes and reservoirs or in tributaries to lakes, generally with two or five bag limit.

For catch-and-release streams, all wild steelhead must be released unharmed. There are significant restrictions on gear used for angling. The CDFG has prepared a draft Fishery Management and Evaluation

Plan (CDFG 2001c), which argues that the upper limit of increased mortality due to sport fishing is about 2.5% in all populations. This estimate is based on an estimated mortality rate of 5% once a fish is hooked, which is consistent with a published meta-analysis of hooking mortality (Schill and Scarpella 1997). Experimental studies on the subject—from which the estimates are made—tend to measure mortality only for a period of a few days or a week after capture (e.g., Titus and Vanicek 1988).

California Coastal chinook salmon (*Oncorhynchus tshawytscha*)

The status of Chinook salmon throughout California and the Pacific Northwest was formally assessed in 1998 (Myers et al. 1998). Substantial scientific disagreement about the biological data and its interpretation persisted for some ESUs, which were reconsidered in a subsequent status review update (NMFS 1999a). Information from those reviews regarding ESU structure, analysis of extinction risk, risk factors, and hatchery influences is summarized in the subsections that follow.

ESU Structure

The initial status review proposed a single ESU of Chinook salmon inhabiting coastal basins south of Cape Blanco, Oregon, and the tributaries to the Klamath River downstream of its confluence with the Trinity River in California (Myers et al. 1998). Subsequent review of an augmented genetic data set and further consideration of ecological and environmental information led to the division of the originally proposed ESU into the Southern Oregon and Northern California Coastal Chinook salmon ESU and the California Coastal Chinook salmon ESU (NMFS 1999a). The California Coastal Chinook salmon ESU currently includes Chinook salmon from Redwood Creek to the Russian River (inclusive).

Summary of Risk Factors and Status

The California Coastal Chinook salmon ESU is listed as threatened. Primary causes for concern were low abundance, reduced distribution (particularly in the southern portion of the ESU's range), and generally negative trends in abundance; all of these concerns were especially strong for spring-run Chinook salmon in this ESU (Myers et al. 1998). Data for this ESU are sparse and in general of limited quality, which contributes to substantial uncertainty in estimates of abundance and distribution. The BRT considered degradation of the genetic integrity of the ESU to be of minor concern and to present less risk for this ESU than for other ESUs.

Previous reviews of conservation status for Chinook salmon in this area exist. Nehlsen et al. (1991) identified three putative populations (Humboldt Bay tributaries, Mattole River, and Russian River) as being at high risk of extinction and three other populations (Redwood Creek, Mad River, and lower Eel River) as being at moderate risk of extinction. Higgins et al. (1992) identified seven "stocks of concern," of which two populations (tributaries to Humboldt Bay and the Mattole River) were considered to be at high risk of extinction. Some reviewers indicate that Chinook salmon native to the Russian River have been extirpated.

Historical estimates of escapement are presented in the table below. These estimates are based on professional opinion and evaluation of habitat conditions, and thus do not represent rigorous estimates based on field sampling. Historical time series of counts of upstream migrating adults are available for Benbow Dam (South Fork Eel River 1938–1975), Sweasy Dam (Mad River 1938–1964), and Cape Horn Dam (Van Arsdale Fish Station, Eel River); the latter represent a small, unknown, and presumably variable fraction of the total run to the Eel River. Data from cursory, nonsystematic stream surveys of two tributaries to the Eel River (Tomki and Sprowl creeks) and one tributary to the Mad River (Canon Creek) were also available; these data provide crude indices of abundance.

Table 21. Historical estimates of abundance of Chinook salmon in the California Coastal Chinook salmon ESU.

Selected watersheds	CDFG[a] (1965)	Wahle and Pearson (1987)
Redwood Creek	5,000	1,000
Mad River	5,000	1,000
Eel River	55,000	17,000
Mainstem Eel River[b]	13,000	–
Van Duzen River[b]	2,500	–
Middle Fork Eel River[b]	13,000	–
South Fork Eel River[b]	27,000	–
Bear River	–	100
Small Humboldt County rivers	1,500	–
Miscellaneous rivers north of Mattole River	–	600
Mattole River	5,000	1,000
Noyo River	50	–
Russian River	500	50
Total	72,550	20,750

[a] CDFG = California Department of Fish and Game.

[b] Entries for subbasins of the Eel River basin are not included separately in the total.

Previous status reviews considered the following to pose significant risks to the California Coastal Chinook salmon ESU: degradation of freshwater habitats due to a variety of agricultural and forestry practices, water diversions, urbanization, mining and severe recent flood events (exacerbated by land use practices). Special concern was noted regarding the more precipitous declines in distribution and abundance in spring-run Chinook salmon. Many of these factors are particularly acute in the southern portion of the ESU and were compounded by uncertainty stemming from the general lack of population monitoring in California (Myers et al. 1998). In previous status reviews, the effects of hatcheries and transplants on the ESU's genetic integrity elicited less concern than other risk factors for this ESU, and were less of a concern compared to other ESUs.

New Data and Updated Analyses

The TRT for the North-Central California Coast (NCCC) recovery domain proposed a set of plausible hypotheses, based largely on geography, regarding the population structure of the California Coastal Chinook salmon ESU, but concluded that information to discriminate among these hypotheses is insufficient (Bjorkstedt et al. in prep.). Data are not available for all potential populations; only those for which data are available are considered below.

Abundance and Trends

New or updated time series for Chinook salmon in this ESU include 1) counts of adults reaching Van Arsdale Fish Station near the effective headwater terminus of the Eel River; 2) cursory, quasi-systematic spawner surveys on Canon Creek (tributary to the Mad River), Tomki Creek (tributary to the Eel River), and Sprowl Creek (tributary to the Eel River); and 3) counts of returning spawners at a weir on Freshwater Creek (tributary to Humboldt Bay). None of these time series is especially suitable for analyzing trends or estimating population growth rates.

Freshwater Creek

Counts of Chinook salmon passing the weir near the mouth of Freshwater Creek, a tributary to Humboldt Bay, provide a proper census of a small ($N \approx 20$) population of natural and hatchery-origin Chinook salmon.

Chinook salmon occupying this watershed may be part of a larger "population" that uses tributaries of Humboldt Bay (NCCC-TRT in prep.). The time series comprises only 8 years of observations, too few to draw strong inferences regarding trends. Clearly, the trend is positive, although the role of hatchery production in producing this signal may be significant.

Mad River

Data for naturally spawning fish are available from spawner surveys on Canon Creek, and to a lesser extent on the North Fork Mad River. Only the counts from Canon Creek extend continuously to the present (Figure 113a). Due to high variability in these counts, short- and long-term trends do not differ significantly from zero, although the tendency is toward a positive trend. Due to a hypothesized, but unquantified, effect of interannual variation in water availability on distribution of spawners in the basin, it is not clear whether these data provide any useful information for the population as a whole; however, more sporadic counts from the mainstem Mad River suggest that the estimates from Canon Creek capture gross signals and support the hypothesis of a recent positive trend in abundance.

Eel River

The Eel River plausibly harbors anywhere from one to five independent populations (NCCC-TRT in prep.). Three current time series provide information for the populations that occupy this basin: 1) counts of adults reaching Van Arsdale Fish Station near the effective headwater terminus of the Eel River; 2) spawner surveys on Sprowl Creek (tributary to the Eel River); and 3) spawner surveys on Tomki Creek (tributary to the Eel River). These data are not especially suited to rigorous analysis of population status for a number of reasons, and sophisticated analyses were not pursued.

Two characteristics of the data weaken inferences regarding population status drawn from the time series of counts of adult Chinook salmon reaching Van Arsdale Fish Station (VAFS). First, adult salmon reaching VAFS include both natural- and hatchery-spawned fish, yet the long-term contribution of hatchery production to the spawner population is unknown and may be quite variable due to sporadic operation of the egg take-and-release programs since the mid-1970s. Second, and perhaps more important, it is not clear what VAFS natural spawner counts indicate about the population or populations of Chinook salmon in the Eel River. As a weir count, measurement error is expected to be small for these counts. However, very little spawning habitat exists above VAFS, which sits just below the Cape Horn Dam. This dearth of habitat suggests that counts made at VAFS represent the upper edge of the spawners' distribution in the upper Eel River. Spawner access to VAFS and other headwater habitats in the Eel River basin is likely to depend strongly on the timing and persistence of suitable river flow, which suggests that a substantial component of the process error in these counts is not due to population dynamics. For these reasons, no statistical analysis of these data was pursued.

Additional data for the Eel River population or populations are available from spawner surveys from Tomki and Sprowl creeks, which yield estimates of abundance based on 1) quasisystematic index site spawner surveys that incorporate mark-recapture analysis of carcasses and 2) additional so-called compatible data from other surveys. Analysis for Sprowl Creek indicates negative long- and short-term trends; similar analysis indicates a long-term decline and short-term increase for Tomki Creek. Caution in interpreting these results is warranted, particularly given the quasi-systematic collection of these data, and the likelihood that these data include unquantified variability due to flow-related changes in spawners' use of mainstem and tributary habitats. In particular, inferences regarding population status based on extrapolations from these data to basinwide estimates of abundance are expected to be weak and perhaps not warranted.

Mattole River

The Mattole Salmon Group has conducted spawner and redd surveys on the Mattole River and tributaries since 1994. The surveys provide useful information on the distribution of salmon and spawning activity throughout the basin. Local experts have used these and ancillary data to develop rough "index" estimates of spawner escapement to the Mattole River; however, the intensity and coverage of these surveys have not been consistent, and the resulting data are not suitable for rigorous estimation of abundance (e.g., through area-under-the-curve analysis).

Russian River

No long-term, continuous time series are available for sites in the Russian River basin, but sporadic estimates based on spawner surveys are available for some tributaries. Video-based counts of upstream migrating adult Chinook passing a temporary dam near Mirabel on the Russian River are available for 2000–2002. Counts are incomplete, due to technical difficulties with the video apparatus, occasional periods of poor water clarity, occasional overwhelming numbers of fish, and disparities between counting and migration periods; thus, these data represent a minimum count of adult Chinook. Counts have exceeded 1,300 fish in each of the last 3 years (5,465 in 2002); and a rigorous mark-recapture estimate of outmigrant abundance in 2002 exceeded 200,000.12 Because Chinook have not been produced at the Don Clausen Hatchery since 1997, these counts represent natural production or straying from other systems. No data were available to assess the genetic relationship of these fish to others in this or other ESUs.

Summary

Historical and current information indicates that abundance in putatively independent populations of Chinook is depressed in many of those basins where they have been monitored. The relevance of recent strong returns to the Russian River to ESU status is not clear because the genetic composition of these fish is unknown. Reduction in geographic distribution, particularly for spring-run Chinook and for basins in the southern portion of the ESU, continues to present substantial risk. Genetic concerns are reviewed below (see subsection, New Hatchery Information, below). As for previous status reviews, uncertainty continues to contribute substantially to assessments of risk facing this ESU.

New Hatchery Information

Hatchery stocks that are considered for inclusion in this ESU are 1) Mad River Hatchery; 2) hatchery activities of the Humboldt Fish Action Council on Freshwater Creek; 3) Yager Creek Hatchery, operated by Pacific Lumber Company; 4) Redwood Creek Hatchery; 5) Hollow Tree Creek Hatchery; 6) Van Arsdale Fish Station; and 7) hatchery activities of the Mattole Salmon Group. Chinook are no longer produced at the Don Clausen Hatchery on Warm Springs Creek (Russian River). In general, hatchery programs in this ESU are not oriented toward large-scale production; rather, they are small-scale operations oriented at supplementing depressed populations.

Freshwater Creek

This hatchery is operated by Humboldt Fish Action Council (HFAC) and the California Department of Fish and Game (CDFG) to supplement and restore natural production in Freshwater Creek. All spawners are from Freshwater Creek; juveniles are marked, and hatchery fish are excluded from use as broodstock. Weir counts provide good estimates of the proportion of hatchery- and natural-origin fish returning to Freshwater Creek (30–70% hatchery from 1997 to 2001); the contribution of HFAC production to spawning runs in other streams tributary to Humboldt Bay is unknown.

Mad River

Recent production from this hatchery has been based on small numbers of spawners returning to the hatchery. There are no estimates of naturally spawning Chinook abundance available for the Mad River to determine the contribution of hatchery production to Chinook in the basin as a whole. Broodstock has generally been drawn from Chinook returning to the Mad River; however, releases in the 1970s and 1980s included substantial releases of fish from out of the basin (Freshwater Creek) and out of the ESU (Klamath-Trinity and Puget Sound).

Eel River

Four hatcheries, none of which are major production hatcheries, contribute to production of Chinook salmon in the Eel River basin: hatcheries on Yager Creek (recent effort is approximately 12 females spawned per year), Redwood Creek (approximately 12 females), Hollow Tree Creek, and the Van Arsdale Fish Station (VAFS) (approximately 60 males and females). At the first three hatcheries, broodstock is selected from adults of nonhatchery origin; at VAFS, broodstock includes both natural and hatchery-origin fish. In all cases, however, insufficient data on naturally spawning Chinook are available to estimate the effect of hatchery fish on production or other characteristics of naturally spawning Chinook in the Eel River basin. Since 1996, all fish released from VAFS have been marked. Subsequent returns indicate that approximately 30% of the adult Chinook trapped at VAFS are of hatchery origin. It is not clear what these numbers indicate about hatchery contributions to the population of fish spawning below VAFS.

Mattole River

The Mattole Salmon Group has operated a small hatchbox program since 1980 (current effort approx. 40,000 eggs from approximately 10 females) to supplement and restore Chinook salmon and other salmonids in the Mattole River. All fish are marked, but no rigorous estimate of hatchery contributions to adult escapement is possible. Hatchery-produced outmigrants comprised approximately 17.3% (weighted average) of outmigrants trapped during 1997, 1998, and 2000 (Mattole Salmon Group 2000). Trapping efforts did not fully span the period of natural outmigration, so this figure may overestimate the contribution of hatchbox production to total production in the basin.

Russian River

Production of Chinook salmon at the Don Clausen (Warm Springs Hatchery) ceased in 1997 and had been largely ineffective for a number of years prior to that. Recent returns of Chinook salmon to the Russian River stem from natural production, and possibly from fish straying from other basins, including perhaps Central Valley stocks.

SUMMARY

Artificial propagation of Chinook salmon in this ESU remains at relatively low levels. No putatively independent populations of Chinook salmon in this ESU appear to be entirely dominated by hatchery production, although proportions of hatchery fish can be quite high where natural escapement is small and hatchery production appears to be successful (e.g., Freshwater Creek). It is not clear whether current hatcheries pose a risk or offer a benefit to naturally spawning populations. Extant hatchery programs are operated under guidelines designed to minimize genetic risks associated with artificial propagation and, save for historical inputs to the Mad River Hatchery stock, do not appear to be at substantial risk of incorporating out-of-basin or out-of-ESU fish. Thus, it is likely that artificial propagation and degradation of genetic integrity do not represent a substantial conservation risk to the ESU.

Comparison with Previous Data

Few new data, and few new data sets, were available for consideration, and none of the recent data contradicts the conclusions of previous status reviews. Chinook salmon in the California Coastal Chinook salmon ESU continue to exhibit depressed population sizes relative to historical abundances; this is particularly true for spring-run Chinook salmon, which may no longer be extant anywhere within the range of the ESU. Evaluation of the significance of recent potential increases in abundance of Chinook salmon in the Russian River must weigh the substantial uncertainty regarding the genetic relatedness of these fish to others in the northern part of the ESU.

Harvest rates are not explicitly estimated for this ESU; however, it is likely that current restrictions on harvest of Klamath River fall-run Chinook salmon maintain low ocean harvest of Chinook from the California Coastal Chinook salmon ESU (PFMC 2002a, 2002b). Potential changes in age-structure of Chinook salmon populations (e.g., Hankin et al. 1993) and associated risk have not been evaluated for this ESU.

No information exists to suggest new risk factors or substantial effective amelioration of risk factors noted in the previous status reviews, except for recent changes in ocean conditions. Recent favorable ocean conditions have contributed to apparent increases in abundance and distribution for a number of anadromous salmonids, but the expected persistence of this trend is unclear.

4. Existing Environment and Project Effects

PROJECT LOCATION

The project is located in the Russian River east of the Town of Geyserville in Sonoma County. It is located on the Geyserville USGS 7.5' Quad at 38°42'46.64"N 122°53'45.15"W. The Russian River, at this crossing has an active channel of approximatley 400 feet wide. However, the main wetted channel, through which flow always passes, is less than 80' wide. The depth of the wetted channel is between 8 and 10 feet, depending on flow amount. Monthly average flow in the Russian River, compiled from a 52 year record, ranges from a high of almost 3500 cubic feet per second (cfs) to a low of less than 250 cfs. See following chart.

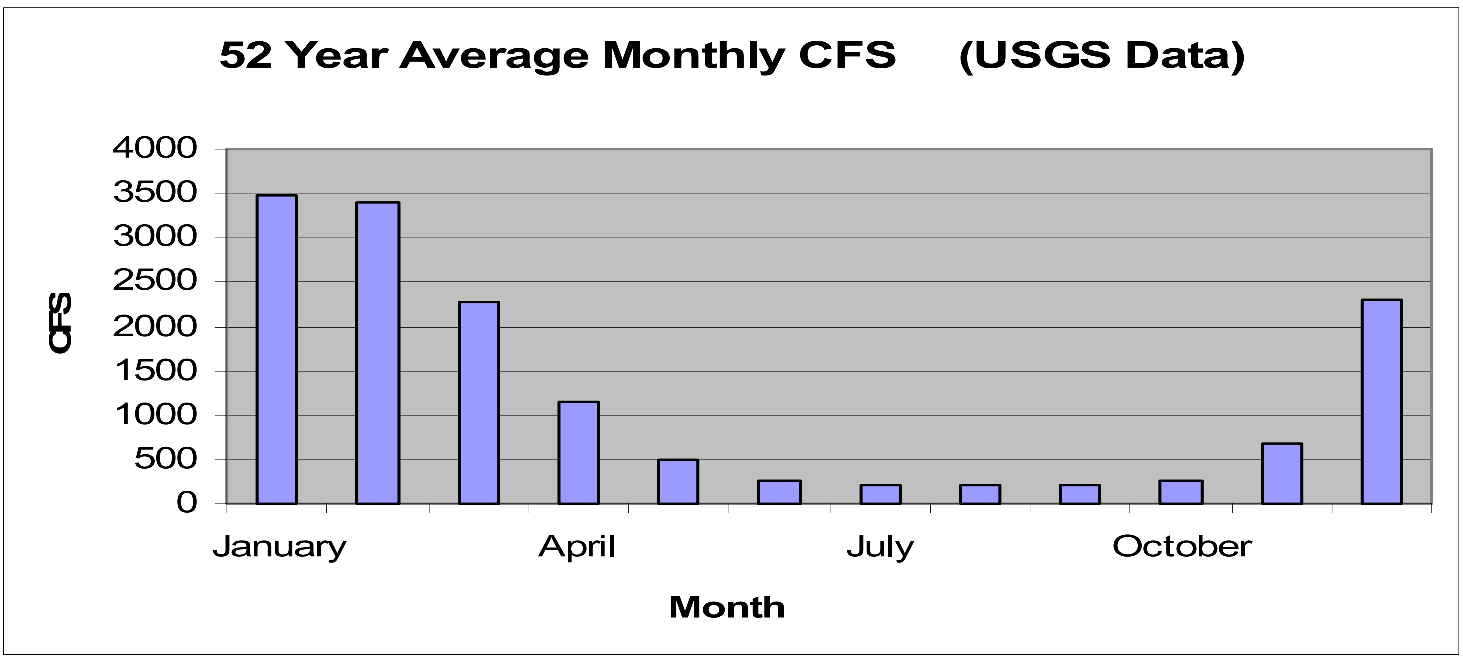

Chart 1. Monthly average flow rates in cfs at the Geyserville Bridge, 52 years of USGS data.

EFFECTS OF PILE DRIVING

Pile driving is the direct project effect that could impact these listed fish at this location. Following is an analysis of the pile driving impacts on fish.

Barotrauma

The pathologies associated with exposure to drastic changes in pressure are collectively known as barotraumas. These include hemorrhage and rupture of internal organs, including the swim bladder and kidneys in fish. Death can be instantaneous, occur within minutes after exposure, or occur several days later. Mammals are known to suffer cardiovascular barotraumas caused by expansion of gas bubbles in the pulmonary capillaries, coronary arteries, internal carotid artery, or the cerebral artery. Bubble expansion in blood vessels can cause an embolism or blockage leading to heart attack or stroke, or a rupture causing hemorrhage. Other tissues with gas-filled voids, such as swim bladders, bowel, sinuses, and lung can perforate and hemorrhage when exposed to blast and high-energy impulse noise underwater (Gisiner, 1998). Fish can also die when exposed to lower sound pressure levels if exposed for longer periods of time. Hastings (1995) found death rates of 50% and 56% for gouramis (*Trichogaster sp.*) when exposed to continuous sounds at 192 dB re: 1 μPa at 400 Hz and 198 dB re: 1 μPa at 150 Hz, respectively, and of 25% for goldfish (*Carassius auratus*) when exposed to sounds of 204 dB re: 1 μPa at 250 Hz for two hours or less. Hastings (1995) also reported that acoustic "stunning," a potentially lethal effect resulting in a physiological shutdown of body functions, immobilized gourami within 8 to 30 minutes of exposure to the aforementioned sounds. The results of these experiments are significant, however they represent a more extreme exposure to fish than would occur during pile driving.

Primary Mechanisms of Barotrauma

Two different underlying mechanisms, bubble growth by "rectified diffusion" and "transient cavitation," are likely responsible for barotraumas that can cause death in aquatic animals as well as humans and other mammals. Bubbles grow during acoustic oscillations in regions of large sound pressure levels by a process called rectified diffusion (or "stable cavitation"). In one cycle of pulsation during this process, more gas diffuses inward from the liquid to the bubble during its expansion than is squeezed out during contraction, primarily because the surface area of the bubble while expanded is much greater than the area while contracted. Small bubbles grow by rectified diffusion until they reach a critical radius, called the Blake threshold, at which they expand explosively if the sound pressure swing is constant. Growth of bubbles in tissue by rectified diffusion can cause inflammation and cellular damage because of increased stress and strain (Vlahakis and Hubmayr, 2000; Stroetz *et al.*, 2001), and blockage or rupture of capillaries, arteries and veins (Crum and Mao, 1996; Conrad, 2001).

Transient cavitation is characterized by violently collapsing bubbles that radiate shock waves and broadband noise. During cavitation the water vapor passes through the bubble wall during expansion and condenses during contraction, which causes the bubble to collapse. Localized high temperatures cause damage, tissue disruption by the shock waves, and the formation of free radicals that react with biochemicals within the tissue. The transient cavitation threshold for frequencies below 10,000 Hz is a continuous wave acoustic pressure with amplitude of about 1 atmosphere (approximately 14.7 psi or 105 Pa equivalent to 220 dB re: 1 μPa peak). This threshold increases with water depth and frequency. For transient sounds, the cavitation threshold increases with decreasing pulse length at water depths greater than about 15 meters (Clay and Medwin, 1977).

Fish Internal Injuries Due to Pile Driving Sound Pressure Levels

Fish exposed to high sound pressure levels will experience trauma in many organs including the inner ear, eyes, blood, nervous system, kidney and liver. The following discussion elaborates on what is known about anatomical and physiological injury mechanisms associated with peak pressures, frequency and duration of exposure.

The swim bladder is an air filled sack in the center of the body cavity bordered by the kidney above and the liver and other internal organs below. In salmonids, the swim bladder is connected to the back of the throat by a small tube referred to as the pneumatic duct (Abbott 1973). The underwater sound pressure wave generated by a pile strike will pass through a fish, rapidly squeezing the swim bladder due to the high pressure and then rapidly expanding the swim bladder as the underpressure component of the wave passes through the fish. At relatively low sound pressure levels, only a fraction of 1 psi above the ambient sound pressure level in the environment, the swim bladder will rhythmically expand and contract with no adverse effect. The swim bladder routinely expands and contracts as salmonids swim near the surface or swim in deeper water near the bottom. At high sound pressure levels of pile driving, the swim bladder may repeatedly expand and contract, hammering the internal organs that cannot move away since they are bound by the vertebral column above and the abdominal muscles and skin that hold the internal organs in place below the swim bladder (Gaspin 1975). This pneumatic pounding may result in the rupture of capillaries in the internal organs as indicated by observed blood in the abdominal cavity, and maceration of the kidney tissues. The pneumatic duct may not make a significant difference in the vulnerability of the salmonids since it is so small relative to the volume of the swim bladder (Gaspin 1975). A very strong shock wave or high pressure/low pressure cycle may result in a rupture of the swim bladder, even forcing some of the viscera out through the anus. In extreme circumstances the body cavity will be ruptured. If the swim bladder bursts and the air escapes from the body cavity or is forced out of the pneumatic duct, the fish may sink to the bottom. If the swim bladder bursts but the air stays inside the body cavity, the fish is likely to stay afloat but have some difficulty in maneuvering or maintaining orientation in the water column.

Internal injury may also be a result of transient cavitation and bubble growth. Assuming a spherically spreading sound wave, the transient cavitation threshold would be about 224 dB re: 1 μPa at a water depth of 17 meters based on data presented in Clay and Medwin (1977). Crum and Mao (1996) analyzed bubble growth underwater by rectified diffusion caused by sound signals at low frequencies (< 5000 Hz), long pulse widths, and atmospheric pressure. They found that sound pressures exceeding 210 dB re: 1 μPa could cause bubble growth within a few seconds, while bubble growth was not expected at sound pressures below 190 dB re: 1 μPa.

Because transient cavitation and bubble growth by rectified diffusion are the primary mechanisms for barotraumas suffered underwater, little or no physical damage to aquatic animals would be expected for peak sound pressures below 190 dB re: 1 μPa. For peak sound pressure levels between 190 and 210 dB re: 1 μPa, some barotrauma injuries would be expected, and above 210 dB re: 1 μPa severe barotraumas and death would most likely occur. Studies on the physiological effects of underwater sound summarized by Gisiner (1998) report sound pressure levels in agreement with these predicted safe levels. Bauman *et al.* (1997) found that 222 dB re: 1 μPa (peak) could result in death due to perforation and hemorrhage of the bowel. Another organ that is affected by high intensity impulsive sound because of gas-containing tissue is the eye. Blindness and hemorrhage occur at peak sound pressure levels of 220 dB re: 1 μPa (Gisiner, 1998). Many of these types of barotraumas pathologies were observed during pile driving without a bubble curtain for the SFOBB PIDP as reported in the PIDP Fisheries Impact Assessment (Caltrans, August 2001).

Fish with swim bladders, however, will be more sensitive to underwater impulsive noise because of swim bladder resonance, which is believed to occur in the frequency band of most sensitive hearing (usually 200 – 800 Hz). As reported by Gisiner (1998), the only study found in the literature on the effects of high intensity impulsive sound is by Turnpenny *et al.* (1994).

As reported by Hastings (2001), who had access only to the Gisiner (1998) report and not the 1994 Turnpenny study, “They examined the effects of underwater impulse noise generated by air guns on fish with swim bladders. They found 50% mortality for brown trout (*Salmo trutta*) occurring at 170 dB re: 1 μPa and frequencies of 95 – 500 Hz, and 50% mortality occurring at 176 dB re: 1 μPa and 95 Hz for bass (*Dicentrarchus labrax*) and whiting (*Merlangius merlangus*). (These sound pressure levels are believed to be RMS values calculated for the duration of the impulse rather than peak values)." Peak and RMS are defined on page 1 of the Reyff et al 2002.

Mortality

The criterion for mortality is the cessation of all gill movements. Shock waves result in injuries to the swim bladder, kidney and liver at a macroscopic level (Yelverton et. al.1975). A fish floating on the surface or sinking to the bottom may be easily categorized as a mortality. However, experiments with explosives indicate that many fish with injuries do not die immediately. Studies on fish exposed to detonation shock waves indicate that 90 percent die within four hours (Yelverton et. al. 1975). However, there is some indication that fish may die up to five days after exposure to a shock wave. The delayed mortality study was not conducted with predators in the immediate environment. Few injured fish live more than a few hours in a natural setting with a balanced community of predators.

Any macroscopically discernable injury or change in behavior is likely to result in excessive predatory pressure and near term mortality even though many fish might be able to recover in a protected environment. No standard criterion for fish injury or harassment exists at this time (Keeven, Personal Communication). The ESA criteria for "harm" cover all listed species including fish. The rupture of the swim bladder, internal bleeding, and the loss of function of the inner ear are equivalent to the loss of a body organ and would constitute a "take" under the ESA.

Stress

Loud sounds can have detrimental effects on fish by causing stress, increasing risk of mortality by reducing predator avoidance capability, and interfering with communication necessary for navigation and reproduction. Scholik and Yan (2001) reported temporary threshold shifts for fathead minnows (*Pimephales promelas*) exposed to 24 hours of white noise with a bandwidth of 300 – 4000 Hz and overall sound pressure level of only 142 dB re: 1 μPa. Their results indicated that the effects could last longer than 14 days. Even if threshold shifts do not occur, loud sounds can mask the ability of aquatic animals to hear their environment. Based on the sound pressures and exposure times for sensory hair cell damage reported by Hastings (1995) and Hastings *et al.* (1996), and an assumption of deposition of equivalent acoustic energy in the inner ear over time, fish could experience damage to the inner ear if they remained in the direct vicinity (at 200-210 dB re: 1 μPa peak sound pressure) of the pile driving activity for more than a few minutes.

Growth Rates

Noise-induced stress can be manifested in reduced growth rates, increased aggressive behavior, startle responses, and tighter schooling. Banner and Hyatt (1973) reported reduced growth rates for sheepshead minnows (*Cyprinodon variegatus*) and killfish (*Fundulus similes*) in tanks with noise levels 20 to 30 dB above ambient, and Terhune *et al.* (1990) noted a 5-8% reduction in smolting rates of Atlantic salmon (*Salmo salar L.*) in tanks with ambient noise levels 4-16 dB higher than other tanks. Shrimp (*Crangon crangon*) exposed to noise levels 20 to 30 dB above normal experienced reduced growth and reproduction, and increased aggression and mortality than a control group (Lagardére, 1982). Pearson *et al.* (1992) conducted one of the few studies on the effects of impulsive sounds from air guns. They studied the behavior of confined rockfish (*Sebastes* spp.) in response to 10-minute exposures to a single 1639-cm^3 air gun and found that the threshold for alarm responses varied from about 180 to 205 dB re: 1 μPa depending on the species. Pearson *et al.* (1992) also reported tighter schooling and movement to the bottom of the water column in response to onset of the impulsive sound and estimated a threshold for subtle behavioral changes of 161 dB re: 1 μPa.

Behavioral Changes

Pile driving may result in "agitation" of the salmonids indicated by a change in swimming behavior (Shin 1995). Salmon and steelhead may exhibit a startle response to the first few strikes of a pile. The startle response is a quick burst of swimming that may be involved in avoidance of predators (Popper 1997). It is associated with the Mauthener cell in the base of the brain. A fish that exhibits a startle response is not in any way injured, but it is exhibiting behavior that suggests it perceives a stimulus indicating potential danger in its immediate environment. Fish do not exhibit a startle response every time they experience a strong hydro-acoustic stimulus. The startle response is likely to extinguish after a few pile strikes.

Factors Affecting the Impact on Anadromous Salmonids in the Project Area

Anadromous salmonids in the project area exposed to high sound pressure levels associated with project pile driving may experience mortality, some slight degree of injury, a degree of stress, a startle response, or no effects whatsoever. The degree of effect depends on many factors including:

Timing and Distribution
Duration of fish presence in project area
Size and force of the hammer strike
Water Depth and Distance from Pile
Depth of the fish in the water column
Amount of air in the water
The texture of the surface of the water (size and number of waves on the water surface)
Bottom substrate composition and texture
Size of the fish
Species of fish
Physical condition of the fish
Effectiveness of Air Bubble Curtain sound / pressure attenuation technology

Central California Coast Coho salmon, Central California Coastal steelhead, Central Valley steelhead, and California coastal chinook salmon must migrate once as adults through the Russian River and through the project site in order to reach their spawning destinations in the Russian River system and then migrate downstream through the project site again as juveniles on their way to the Pacific Ocean. Juveniles will emigrate as young-of-the-year (YOY) and yearlings. For adults on their freshwater migration to upstream natal streams to spawn, the year-class composition of the migrating population will differ based on race and species. The majority of returning adult chinook salmon returns as three-year-old fish along with some immature grilse and a few four-year-olds (Fisher 1993; Hallock and Fisher 1985; Snider et. al. 2001).

Thus, impacts from pile driving can be expected to affect some unknown but likely small fraction of several year-classes of Central California Coast Coho salmon, Central California Coastal steelhead, Central Valley steelhead, and California coastal chinook salmon.

The specific months when adult or juvenile Central California Coast Coho salmon, Central California Coastal steelhead, Central Valley steelhead, and California coastal chinook salmon may be present in the project area is summarized in Chart 2 below.

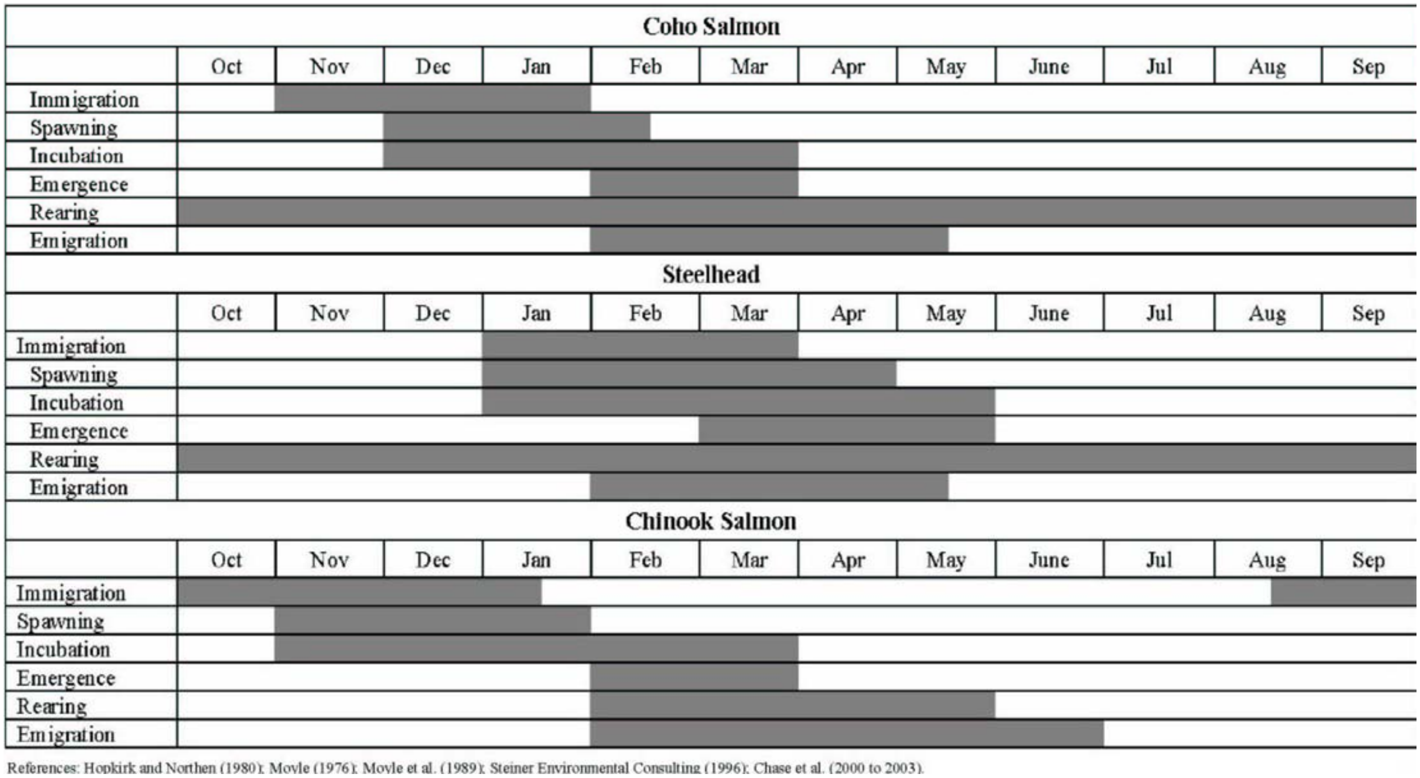

Chart 2. Fish Phenology for the Russian River.

While some juvenile “fingerling” salmonids migrate downstream during the day, the majority of downstream movement has been found to occur at night (Hatton 1940; Schaffter 1980; Mains and Smith 1964, Lister et al. 1971; both as cited in Healey 1991). Simenstad (et al. 1982), in a review of past research on habitat utilization of juvenile chinook in estuaries, reported that yearling chinook move directly into neritic habitats without much utilization of salt marsh or other shallow habitats although neritic areas associated with contained embayments may be preferred. As steelhead outmigrants have also been found to use swifter mid-channel habitat during their outmigration through the Delta (Schaffter 1980), it may be assumed that they would also use the swifter main channel of the Russian River.

Adults use a variety of orientation cues to navigate upstream including olfactory and salinity gradient. Like juvenile salmon and steelhead, returning adult chinook and steelhead migrating upstream to spawn are also likely to move by directed swimming and make use of selective tidal transport. In the course of a four-year study from 1964 to 1967 where the California Department of Fish and Game sonic tagged and radio-tracked 316 adult fall-run chinook salmon through the Delta, researchers did not detect any obvious tendency of tagged salmon to travel with or against tidal currents in getting from place to place. During both ebb and flood tides, some fish were roughly stationary, some were moving against the tide, and some with it. During slack tides, salmon might be moving in any direction or none at all (Hallock et al. 1970). Adults do not use passive tidal drift to migrate upstream.

Central California Coast Coho salmon, Central California Coastal steelhead, Central Valley steelhead, and California coastal chinook salmon presence within the project area is expected to be transitory and fish would not seek to remain in the project vicinity. The majority of coho, chinook and steelhead outmigration is expected to occur from dusk to dawn, a daily time-period when no pile driving is expected to occur (Hatton 1940; Schaffter 1980). Few numbers would be present around the project site at any one time and the number of fish exposed to pile driving would represent a very small portion of each species overall population. Impact to each species, as a result of pile driving, would occur as juveniles and adults migrate through the Russian River.

PROPOSED NOISE ATTENUATION MEASURES

Caltrans, in consultation with FHWA and NOAA, have developed the following measures to reduce salmonid take associated with this action.

Construct the temporary trestle using piles: a) not greater than 24-inch diameter in areas where the riverbed is not wetted or otherwise inundated by the river, and b) not greater than 12-inch diameter where the riverbed is wetted or otherwise under water. If, due to schedule and weather considerations, it is necessary to drive trestle piles in the active channel, these piles, will be isolated from the water column by an isolation casing of adequate size to accommodate the placement of an air bubble curtain between the isolation casing and pile.

Delay installation of all large diameter permanent piles (*i.e*., 48-60-inch diameter) as late as possible during the period March through June 15. Ideally, these large diameter piles should be installed during the period June 15 to September 1. To help minimize potential adverse effects, Caltrans and its contractors will first install large diameter piles in areas where the riverbed is not wetted (*i.e*., inundated by the river), deferring installation of large diameter piles in wetted areas until the end of the period of active pile driving.

All pile driving activities will have a digital record of each pile strike, including pile number, pile size and type, hammer size and type, distance to wetted channel (if not in water), water depth (if in water), date and time of installation, energy imparted to pile, and number of strikes.

Pile driving for the new bridge shall commence with Bent 10 on the easterly end of the project and proceed westerly to Bent 6. Piles at these bents, which are at locations above the waterline, may be driven with a vibratory hammer or with an impact hammer of proper size.

All pile driving, both for the trestle and the new bridge, is restricted to the hours between 8 am and 4 pm.

Hydroacoustic monitoring and recording within the wetted active channel at various distances shall be taken during the driving of piles for Bents 2, 3, 4, and 5. Readings shall be taken at one pile per bent and include both the vibratory installation and the impact hammer driving.

Hydroacoustic monitoring and recording within the wetted active channel at various distances shall be taken during the driving of representative piles for the temporary trestle and for the piles necessary to stabilize the broken Pier on the old bridge.

Pile driving for Bents 2, 3, and 4 shall proceed with Bent 2 and proceed easterly. Piles at these bents shall be driven with a vibratory hammer until refusal and then driven to tip with an impact hammer of proper size. Pile driving for Bents 2, 3, and 4 shall be driven when the gravel bed is dry. If the gravel bed does not dry, an isolation system, as described below, will be utilized.

Pile driving for Bent 5 shall be the last piles driven. These piles, as they are likely to be in the active wetted channel, will be isolated from the water column by an isolation casing of adequate size to accommodate the placement of an air bubble curtain between the isolation casing and pile.

Piles at Bent 5, the piles most likely to be in the active wetted channel, will be driven with a vibratory hammer until refusal and then driven to tip with an impact hammer.

The safe collection and relocation of all fish in small, backwatered channels in the immediate vicinity of the existing bridge and site of the temporary trestle.

Further exclusion and/or the safe removal of fishes from those channels or newly formed backwatered areas during the period of construction.

Implementation of Caltrans' best management practices to reduce impacts to aquatic environments including, but not limited to, operations that minimize the footprint of the project site with special effort made to avoid unnecessary impacts to riparian vegetation, stream bank stability, and water pollution from all machinery and project activities.

Implementation of the above measures will minimize the pile driving impacts to the adult or juvenile Central California Coast Coho salmon, Central California Coastal steelhead, Central Valley steelhead, and California coastal chinook salmon that may be present in the project area during construction.

5. Cumulative Effects

Cumulative effects are defined in 50 CFR 402.02 as "those effects of future State or private activities, not involving Federal activities that are reasonably certain to occur within the action area of the Federal action subject to consultation." For the purposes of this analysis, the action area encompasses just the Russian River basin in the vicinity of Geyserville.

Non-Federal actions that may affect the action area include State angling regulation changes, voluntary State or private sponsored habitat restoration activities, State hatchery practices, agricultural practices, water withdrawals/diversions, increased population growth, mining activities, and urbanization. State angling regulations are moving generally towards greater restrictions on sport fishing to protect listed fish species. Habitat restoration projects may have short-term negative effects associated with in-water construction work, but these effects are temporary, localized, and the outcome is typically a benefit to these listed species. State hatchery practices may have negative effects on naturally produced salmonids through genetic introgression, competition, and disease transmission resulting from hatchery introductions. Farming activities within or adjacent to the action area may have negative effects on the Russian River water quality due to runoff laden with agricultural chemicals. Future urban development and mining operations in the action area may adversely affect water quality and estuarine productivity.

6. CONCLUSION

After reviewing the current status of Central California Coast coho salmon (Oncorhynchus kisutch), Central California Coastal steelhead, (O. mykiss), Central Valley steelhead (O. mykiss) and California coastal chinook salmon (O. tshawytscha), the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is concluded that the action, as proposed, is not likely to jeopardize the continued existence of these species. Some minor permanent destruction and adverse modification of the salmonid designated critical habitats may occur, however, construction of this project will reduce the overall bridge infrastructure footprint within the Russian River.

7. Amount or Extent of Take Anticipated

"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 to include significant habitat modification or degradation that results in death or injury to listed species 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 an incidental take statement.

It is anticipated that take associated with construction of the Geyserville Bridge project could be in the form of injury, harassment, and disturbance through pile driving impacts and temporary and permanent habitat impacts.

The number of Coho, Chinook or Steelhead that will be injured or killed can not be accurately estimated. There is no perceived risk of a population level effect.

GEYSERVILLE REFERENCES

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GEYSERVILLE USGS QUAD SPECIES LIST PROVIDED BY US FISH AND WILDLIFE SERVICE

Federal Endangered and Threatened Species that Occur in
or may be Affected by Projects in the Counties and/or
U.S.G.S. 7 1/2 Minute Quads you requested

Document Number: 060205083733

Database Last Updated: December 23, 2005

CRITICAL HABITAT:

On August 11, 2005, the Service published a revised critical habitat designation for vernal pool species. It did not specify critical habitat locations on a species by species basis. If there are species on the list(s) below that were covered under the rule, they are shown because we believe that they are present in the area or may be affected by projects in the area, not because it has specifically been designated as critical habitat for them.

Quad Lists

GEYSERVILLE (518B)

Listed Species

Invertebrates

Syncaris pacifica - California freshwater shrimp (E)

Fish

Oncorhynchus kisutch - coho salmon - central CA coast (E)

Oncorhynchus kisutch - Critical habitat, coho salmon - central CA coast (X)

Oncorhynchus mykiss - Central California Coastal steelhead (T)

Oncorhynchus mykiss - Central Valley steelhead (T)

Oncorhynchus mykiss - Critical habitat, Central California coastal steelhead (X)

Oncorhynchus tshawytscha - California coastal chinook salmon (T)

Oncorhynchus tshawytscha - Critical habitat, California coastal chinook salmon (X)

Birds

Haliaeetus leucocephalus - bald eagle (T)

Strix occidentalis caurina - northern spotted owl (T)

Plants

Cordylanthus tenuis ssp. capillaris - Pennell's bird's-beak (E)

Species of Concern

Invertebrates

Carterocephalus palaemon ssp. - Sonoma arctic skipper (SC)

Fish

Hysterocarpus traski pomo - Russian River tule perch (SC)

Pogonichthys macrolepidotus - Sacramento splittail (SC)

Amphibians

Rana aurora aurora - Northern red-legged frog (SC)

Rana boylii - foothill yellow-legged frog (SC)

Reptiles

Clemmys marmorata marmorata - northwestern pond turtle (SC)

Birds

Agelaius tricolor - tricolored blackbird (SC)

Baeolophus inornatus - oak titmouse (SLC)

Chaetura vauxi - Vaux's swift (SC)

Cypseloides niger - black swift (SC)

Elanus leucurus - white-tailed (=black shouldered) kite (SC)

Empidonax traillii brewsteri - little willow flycatcher (CA)

Falco peregrinus anatum - American peregrine falcon (D)

Lanius ludovicianus - loggerhead shrike (SC)

Numenius americanus - long-billed curlew (SC)

Selasphorus sasin - Allen's hummingbird (SC)

Toxostoma redivivum - California thrasher (SC)

Mammals

Arborimus pomo - California red tree vole (SC)

Corynorhinus (=Plecotus) townsendii townsendii - Pacific western big-eared bat (SC)

Eumops perotis californicus - greater western mastiff-bat (SC)

Myotis evotis - long-eared myotis bat (SC)

Myotis thysanodes - fringed myotis bat (SC)

Myotis volans - long-legged myotis bat (SC)

Myotis yumanensis - Yuma myotis bat (SC)

Plants

Arctostaphylos stanfordiana ssp. decumbens - Rincon manzanita (SC)

Brodiaea californica var leptandra - narrow-anthered California brodiaea (SLC)

Ceanothus confusus - Rincon Ridge ceanothus (SC)

Horkelia tenuiloba - thin-lobbed (=Santa Rosa) horkelia (SLC)

Key:

(E) Endangered - Listed (in the Federal Register) as being in danger of extinction.

(T) Threatened - Listed as likely to become endangered within the foreseeable future.

(P) Proposed - Officially proposed (in the Federal Register) for listing as endangered or threatened.

(NMFS) Species under the Jurisdiction of the National Marine Fisheries Service. Consult with them directly about these species.

Critical Habitat - Area essential to the conservation of a species.

(PX) Proposed Critical Habitat - The species is already listed. Critical habitat is being proposed for it.

(C) Candidate - Candidate to become a proposed species.

(CA) Listed by the State of California but not by the Fish & Wildlife Service.

(D) Delisted - Species will be monitored for 5 years.

(SC) Species of Concern/ (SLC) Species of Local Concern - Other species of concern to the Sacramento Fish & Wildlife Office.

(V) Vacated by a court order. Not currently in effect. Being reviewed by the Service.

(X) Critical Habitat designated for this species