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

July 30, 2012

In response refer to:
2012/02017

Ms. Jane Hicks
Chief, Regulatory Division
U.S. Army Corps of Engineers
San Francisco District
1455 Market Street
San Francisco, California 94103-4573

Dear Ms. Hicks:

This letter transmits NOAA's National Marine Fisheries Service's (NMFS) final biological opinion (Enclosure 1) and Essential Fish Habitat (EFH) consultation (Enclosure 2) pertaining to the U.S. Army Corps of Engineers' (Corps) proposed issuance of an individual section 404 Clean Water Act permit to the Humboldt County Department of Public Works (County) for the Chadd Creek Flow Capacity Improvement Project (project).

The project is proposed to occur once annually, as necessary, for 10 calendar years beginning in 2012 and expiring on October 15, 2021, and consists of excavating approximately 90 cubic yards of sediment in an area within and adjacent to the Holmes Flat Road culvert. The culvert is located within Chadd Creek, a tributary to the Eel River in Humboldt County, California.

The biological opinion is based on NMFS' review of information provided within the Corps' March 8, 2012, request for formal consultation, a January 2012 project biological assessment (BA) prepared by the County, and a site visit that occurred on May 25, 2012.

The biological opinion addresses potential adverse effects on the following listed species Evolutionarily Significant Unit (ESU) or Distinct Population Segment (DPS) and designated critical habitat in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 § *et seq.*):

Southern Oregon/Northern California Coast (SONCC) coho salmon ESU
(*Oncorhynchus kisutch*)
Threatened (70 FR 37160, June 28, 2005)
Designated critical habitat (64 FR 24049, May 5, 1999)

California Coastal (CC) Chinook salmon ESU
(*O. tsawytscha*)
Threatened (70 FR 37160, June 28, 2005)
Designated critical habitat (70 FR 52488, September 2, 2005)
Northern California (NC) steelhead DPS
(*O. mykiss*)
Threatened (71 FR 834, January 5, 2006)
Designated critical habitat (70 FR 52488, September 2, 2005)

Based on the best scientific and commercial information available, in the biological opinion NMFS concluded that the action, as proposed, is not likely to jeopardize the continued existence of SONCC coho salmon, CC Chinook salmon, or NC steelhead; and is not likely to result in the destruction or adverse modification of designated critical habitat for SONCC coho salmon, CC Chinook salmon, or NC steelhead. NMFS expects the proposed action will result in incidental take of SONCC coho salmon and NC steelhead. An incidental take statement is included with the enclosed biological opinion. The incidental take statement includes non-discretionary reasonable and prudent measures and terms and conditions that are expected to further reduce incidental take of SONCC coho salmon and NC steelhead occurring as a result of the proposed action.

The enclosed EFH consultation (Enclosure 2) was prepared pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA, 16 U.S.C. § 1855(b)). The proposed action includes areas identified as EFH for coho salmon and Chinook salmon, Pacific Salmon species managed under the Pacific Coast Salmon Fishery Management Plan. Based on our analysis, NMFS concludes that the project would adversely affect EFH for coho salmon and Chinook salmon. However, the proposed action contains adequate measures to avoid, minimize, mitigate, or otherwise offset the adverse effects to EFH. Therefore, NMFS has no additional Conservation Recommendations.

If you have any questions regarding this consultation, please contact Zane Ruddy at (707) 825-5173 or zane.ruddy@noaa.gov.

Sincerely,

for Rodney R. McInnis
Regional Administrator

Enclosures

cc: Christina Cavett-Cox, Corps, Eureka, California
Doug Dinsmore, Humboldt County Dept. of Public Works, Eureka, California
Copy to file: 151422SWR2012AR00296

**Enclosure 1**

# BIOLOGICAL OPINION

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|---|---|
| **ACTION AGENCY:** | U.S. Army Corps of Engineers |
| **ACTION:** | County of Humboldt Chadd Creek Flow Capacity Improvement |
| **CONSULTATION CONDUCTED BY:** | National Marine Fisheries Service, Southwest Region |
| **FILE NUMBER:** | 151422SWR2012AR00296 |
| **DATE ISSUED:** | **July 30, 2012** |

## I. BACKGROUND AND CONSULTATION HISTORY

On March 12, 2012, NOAA's National Marine Fisheries Service (NMFS) received a letter from the Army Corps of Engineers (Corps) requesting formal consultation pursuant to section 7(a)(2) of the Endangered Species Act (ESA), as amended (16 U.S.C. § 1531 *et seq.*) and its implementing regulations (50 CFR Part 402) for the proposed issuance of a section 404 Clean Water Act Permit to the County of Humboldt (County) for the proposed flow capacity improvement activities (project) in Chadd Creek, a tributary of the mainstem Eel River, in Humboldt County, California. The request for consultation concerns the effects of the proposed project and associated activities on threatened Southern Oregon/Northern California Coast (SONCC) coho salmon (*Oncorhynchus kisutch*), California Coastal (CC) Chinook salmon (*O. tshawytscha*), Northern California (NC) steelhead (*O. mykiss*) and their designated critical habitats. A complete administrative record for this consultation is in the NMFS Northern California Office.

## II. DESCRIPTION OF THE PROPOSED ACTION

The Corps proposes to issue a section 404 Clean Water Act Permit to the County to excavate sediment annually from Chadd Creek to improve flow capacity and prevent flooding at the concrete box culvert located beneath Holmes Flat Road in Humboldt County, California. Project activities would occur once annually for the proposed 10 year permit period (2012–2021).

### A. Sediment Excavation

The County proposes to remove approximately 90 cubic yards of sediment each year from 1,200 square feet of Chadd Creek. Sediment excavation would occur within the culvert and the area approximately 50 feet upstream and downstream of the culvert. The three-chambered concrete culvert spans the entire width of the channel (approximately 18 feet) and is approximately 20 feet long. All heavy equipment used for excavation would be staged and operated outside of the stream channel on Holmes Flat Road or the adjacent turnout. The excavation and removal activities are estimated to take two days to complete each year and will occur between June 1 and October 15. If surface flow is present, excavation will likely occur within the active channel. Following excavation, sediment would be taken to the County's designated upland storage location and the channel would be graded to restore the creek's natural contours. Juvenile salmonids are known to inhabit the project area; therefore, fish capture and relocation will occur prior to the start of sediment removal.

Prior to fish capture and relocation, which will be performed by California Department of Fish and Game (CDFG) or other qualified professionals, the following site preparation activities will occur:

1. Fish exclusion fencing (1/4-inch mesh hardware cloth) would be placed across the wetted channel at both upstream and downstream locations.
2. Silt fencing would be placed across the wetted portion of the channel downstream of the work zone.

3. Fish will be excluded from the work zone to the maximum extent practicable by utilizing the "broom" technique or by dragging a weighted block net from the upstream fish exclusion fencing to the downstream fish exclusion fencing.

### B. Description of Proposed Minimization Measures

To minimize exposure of listed individuals to project activities, all fish present following exclusion activities will be captured and relocated to a nearby area with suitable habitat outside of the work area. Fish relocation will be conducted by qualified fisheries biologists following both California Department of Fish and Game (CDFG) and NMFS guidelines. The County will use best management practices (BMPs) to control sediment and other potential pollutants from entering Chadd Creek during project activities. No riparian trees (that either provide or could potentially provide shade over the water) will be removed.

The County has proposed the following measures to minimize effects to threatened salmonids:

1. Once work is performed, the areas designated for equipment staging and storage will be groomed and mulched with hay to protect against erosion.
2. Sediment stockpiles will be located away from Chadd Creek at the nearby turnout, which is located behind an existing earthen berm. Stockpiles will be isolated with silt fences and hay bales to prevent sediment from entering nearby stream or drainage ditches in case of an unexpected precipitation event. Excavated sediment will be hauled off to a County disposal site once the project is complete.
3. Workers will be instructed to minimize disturbance of vegetation. Any vegetation, debris, or other material removed during construction will be taken off site for disposal.
4. Equipment will be monitored regularly for leaks. In the event of an identified leak, the equipment will be immediately taken off site for repair. Spill response kits will be on-site and readily accessible. Fueling or equipment maintenance will be performed in a pre-designated area, with containment and clean-up BMPs in place.

### C. Interrelated and Interdependent Actions

NMFS does not anticipate any interdependent or interrelated actions associated with the proposed action.

### D. Description of the Action Area

Action area is defined as "all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action" (50 CFR Part 402.02). The action area for this consultation includes the proposed work area within and adjacent to Chadd Creek and extends approximately 100 feet downstream of the excavation site.

## III. ANALYTICAL APPROACH

Pursuant to ESA section 7(a)(2), Federal agencies are directed to insure that any federal action is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. To evaluate whether an action is likely jeopardize listed species or result in the destruction or adverse modification of designated critical habitat,

NMFS considers the combination of the status of the species and critical habitat, effects of the action, including the interrelated and interdependent actions, the Environmental Baseline, and cumulative effects. An action that is not likely to jeopardize the continued existence of the listed species is one that is not likely to appreciably reduce the likelihood of both the survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution (50 CFR Part 402.02). This Biological Opinion (Opinion) does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 CFR Part 402.02. Instead, the statutory provisions of the ESA are relied upon with respect to critical habitat.

NMFS uses a conceptual model of the species and their critical habitat to evaluate the effects of proposed actions. The guiding principle behind this conceptual model is that the likelihood of both the survival and recovery of a species is dependent on the likelihood of both the survival and recovery of populations, and diversity strata, in the species. Additionally, the likelihood of survival and recovery of a population unit is dependent upon the fitness (*i.e.,* reproductive success) of the individuals that comprise each population.

One prerequisite for predicting the risks posed by a proposed action on a population includes an understanding of whether the population is likely to experience viability, *i.e*., the hypothetical state in which extinction risk of the broad population is negligible over 100 years and full evolutionary potential is retained (McElhany *et al.* 2000). NMFS equates this likelihood of viability with the likelihood of both the survival and recovery for purposes of conducting jeopardy analyses under section 7(a)(2) of the ESA. Four principal parameters will be used to evaluate the extinction risk for the threatened SONCC coho salmon ESU, NC steelhead DPS, and CC Chinook salmon ESU: abundance, population growth rate, population spatial structure, and population diversity.

The expected response of salmonid populations to the proposed action is determined by assessing any reductions in the numbers, reproduction, distribution or diversity of listed salmonid populations in the action area. We then determine whether any anticipated reductions would appreciably reduce the likelihood of both the survival and recovery of the affected listed salmonid populations. Finally, NMFS considers the status and trends of the ESU or DPS, the factors currently and cumulatively affecting them, and the role the affected population likely plays in the conservation of the ESU or DPS to determine if reductions in the populations' likelihood of both survival and recovery would be expected to reduce both the likelihood of survival and recovery of the species at the ESU or DPS level.

NMFS adopted the general life cycle approach outlined by McElhany *et al.* (2000), and the concept of Viable Salmonid Populations (VSP) as an organizing framework in consultations. In this Opinion, the concept of VSP is used to systematically examine the complex linkages between project effects and viability. The four VSP parameters (abundance, population growth rate (productivity), population spatial structure, and population diversity) reflect general biological and ecological processes that are critical to the growth and survival, and are used to evaluate the risk of extinction (McElhany *et al.* 2000). These parameters are used as surrogates for the "reproduction, numbers, or distribution" criteria found within the regulatory definition of jeopardy (50 CFR Part 402.02). The fourth VSP parameter, diversity, relates to all three criteria.

## A. Jeopardy Analysis

Analysis of "jeopardy" is conducted in a series of steps. First, available evidence is examined to identify direct and indirect physical, chemical, and biotic effects of the proposed actions on individual members of listed species or aspects of the species' environment in the action area. These effects are considered in the context of the past and present impacts of all Federal, State, Tribal, and private actions in the action area, as well as the anticipated impacts of all Federal, State, Tribal, or private actions that are reasonably certain to occur in the future. For example, if a proposed project is expected to result in increased water temperature, then the effects of that additional temperature increase to salmonids is considered in the context of the existing temperature, which may be influenced by the environmental baseline and future, state, Tribal, or private activities. These effects are discussed in the *Environmental Baseline and Cumulative Effects* sections of this Opinion.

After identifying the effects of the action in the context of other effects as identified in the *Environmental Baseline and Cumulative Effects* sections, available evidence is evaluated to identify the probable response of individuals of a species, including behavioral responses. These responses are then assessed to determine if they can reasonably be expected to reduce a species' reproduction, numbers, distribution, or diversity. Lastly, the results are considered in assessing whether any reductions would reasonably be expected to appreciably reduce a species' likelihood of surviving and recovering in the wild.

## B. Adverse Modification Analysis

Analysis of "destruction or adverse modification" of designated critical habitat involves a series of steps. First, available evidence is used to determine the current condition of critical habitat across the entire designated area (including the action area), including the primary constituent elements of critical habitat (such as spawning habitat, rearing habitat, or freshwater migration corridors) and essential features (including spawning gravels, water quality, cover/shelter, and food), the factors responsible for that condition, and the current conservation value. The importance of critical habitat to species conservation (*e.g.*, key spawning sites) in the action area is identified. Proposed activities are assessed in regard to how they are likely to affect the primary constituent elements or habitat qualities essential to species conservation in the action area (*e.g.*, destabilizing spawning substrate). Finally, anticipated stressors are examined to determine if they could reasonably be expected to appreciably reduce the value of critical habitat for species conservation across the entire designated area.

# IV. STATUS OF THE SPECIES

In the *Status of the Species* section, we present the effects of all past human and natural activities or events that have led to the current status of the species. This section focuses specifically on the discrete recovery unit; at the ESU or DPS scale. Additionally, when designated critical habitat is affected a companion analysis is done for that habitat. Appropriate information on the species' life history, its habitat and distribution, and other data on factors necessary to the species survival and recovery, are included to provide background for analysis in later sections.

The proposed action may affect SONCC coho salmon, CC Chinook salmon, NC steelhead, and their designated critical habitats in the action area. Therefore, this Opinion analyzes the effects

of the proposed action on SONCC coho salmon, CC Chinook salmon, NC steelhead and their designated critical habitats. The SONCC coho salmon and CC Chinook salmon ESUs include hatchery-born salmon from specific hatcheries. Also, the NC steelhead DPS includes the North Fork Gualala River Hatchery.

Table 1 presents a summary of the *Federal Register* (FR) Notice dates and citations, and geographic distributions for these species and critical habitats. This section of the Opinion describes the status of critical habitat, and population trends at the ESU or DPS scale. Information on abundance and distribution, along with a description of designated critical habitat in the action area, is provided in the *Environmental Baseline* section.

**Table 1.** The Scientific name, listing status under the ESA, FR notice citation, and geographic distribution of the ESUs and DPS addressed in this Opinion.

| | **SONCC Coho Salmon ESU** | **NC Steelhead DPS** | **CC Chinook Salmon ESU** |
|---|---|---|---|
| **Scientific Name** | *Oncorhynchus* (*O.*) *kisutch* | *O. mykiss* | *O. tshawytscha* |
| **Listing Status** | Threatened | Threatened | Threatened |
| ***Federal Register* Notice** | 6/28/2005 (70 FR 37160) | ESU listed on June 7, 2000 (65 FR 36074) Relisted as a DPS on January 5, 2006 (71 FR 834) | 6/28/2005 (70 FR 37160) |
| **Geographic Distribution** | From Cape Blanco, Oregon, to Punta Gorda, California | From Redwood Creek (Humboldt County), southward to, but not including, the Russian River | From Redwood Creek (Humboldt County) south to, and including, the Russian River |
| **Critical Habitat Designation** | 5/5/1999 (64 FR 24049) | 9/2/2005 (70 FR 52488) | 9/2/2005 (70 FR 52488) |

## A. Species Life History, Distribution, and Abundance

Life history diversity of federally listed species substantially contributes to their persistence, and conservation of such diversity is a critical element of recovery efforts (Beechie *et al.* 2006). Waples *et al.* (2001) and Beechie *et al.* (2006) found that life history and genetic diversity of Pacific salmon and steelhead (*Oncorhynchus* spp.) show a strong, positive correlation with the extent of ecological diversity experienced by a species.

1. CC Chinook Salmon

*a. Life History*

Adult Chinook salmon reach sexual maturity usually at 3 to 5 years of age, and die soon after spawning. Precocious 2 year olds, especially male jacks, make up a relatively small percentage of the spawning population. Healey (1991) describes two basic life history strategies for Chinook salmon, stream-type and ocean-type, within which there is a tactical component that encompasses variation within race. Like most salmonids, Chinook salmon have evolved with variation in juvenile and adult behavioral patterns, which can help decrease the risk of catastrophically high mortality in a particular year or habitat (Healey 1991).

Fall-run Chinook salmon are ocean-type (Moyle 2002); specifically adapted for spawning in lowland reaches of big rivers and their tributaries (Moyle 2002, Quinn 2005). Sexually mature adults move into rivers and streams from the ocean in the fall or early winter and spawn within a few weeks or days upon arrival on the spawning grounds (Moyle 2002). Juveniles emerge from the gravel in late winter or early spring and within a matter of months, migrate downstream to the estuary and the ocean (Moyle 2002, Quinn 2005). This life history strategy allows fall-run Chinook salmon to utilize quality spawning and rearing areas in the valley reaches of rivers, which are often too warm to support juvenile salmonid rearing in the summer (Moyle 2002).

Spring-run Chinook salmon are often stream-type (Healey 1991, Moyle 2002). Sexually immature adults return to lower-order headwater streams in the spring or early summer and hold in deep pools and coldwater areas until they spawn in early fall (Healey 1991, Moyle 2002). This strategy allows spring-run Chinook salmon to take advantage of mid-elevation habitats that are inaccessible during the summer and fall due to low flows and high water temperatures (Moyle 2002). Juveniles emerge from the gravel in the early spring and typically spend one year in freshwater before migrating downstream to estuaries and then the ocean (Moyle 2002).

*b. Current Distribution and Abundance*

CC Chinook salmon are distributed at the southern end of the species' North American range; only Central Valley fall-run Chinook salmon are found spawning farther south. Only fall-run Chinook salmon currently occur in the CC Chinook salmon ESU. Spring-run stocks no longer occur in the ESU; however, historical information indicates that spring-run Chinook salmon may have existed in the Mad River and the North and Middle forks of the Eel River (Keter 1995, Myers *et al*. 1998, Moyle 2002).

NMFS identified four regions of this portion of the California coast with similar basin-scale environmental and ecological characteristics (Bjorkstedt *et al*. 2005). Sixteen watersheds were identified in these four regions that have the minimum amount of habitat available to support independently viable populations. In the North Mountain-Interior Region, the Upper Eel and Middle Fork Eel rivers contain independent CC Chinook stocks while the Lower Eel and Van Duzen rivers have the potential to support viable populations. Chinook salmon are annually observed in the Middle Fork Eel River, Black Butte River, and near Williams Creek. They continue to be observed annually in Outlet Creek and in the smaller tributaries feeding Little Lake Valley (Scott Harris, pers. comm. 2009).

In the North Coastal Region, Redwood Creek and the Mad, Lower Eel, South Fork Eel, Bear and Mattole Rivers all contain sufficient habitat for independently viable CC Chinook salmon populations. NMFS also identified Little River and Humboldt Bay tributaries as containing potentially independent populations. In the North-Central Coastal Region, numerous watersheds in Mendocino County contain (or contained) small runs of CC Chinook salmon that are dependent upon self-sustaining stocks in Ten Mile, Noyo, and Big rivers for persistence.

Along the Central Coastal Region, the Navarro, Garcia and Gualala rivers historically had independent populations but apparently no longer do. Additionally, the Russian River appears to support a self-sustaining population although the role of hatcheries and straying from the Eel River (by fish attracted to Eel River water which has been diverted into the Russian River) is uncertain. Additionally, 17 watersheds were identified by NMFS to contain CC Chinook salmon, but due to limited habitat were believed not to support persisting populations (Good *et al.* 2005). While Chinook salmon are also encountered in the San Francisco Bay region, these fish most likely originated from Central Valley populations and are not included in the ESU (Moyle *et al*. 2008). Available information on the historical abundance of CC Chinook salmon are summarized in Myers *et al.* (1998). The following are excerpts from this document:

> Estimated escapement of this ESU was 73,000 fish, predominantly in the Eel River (55,500) with smaller populations in Redwood Creek, Mad River, Mattole River (5,000 each), Russian River (500), and several small streams in Del Norte and Humboldt Counties.

Observed widespread declines in abundance and distribution of small populations with sometimes sporadic occurrences contribute to the risks faced by this ESU. Low abundance, generally negative trends in abundance, reduced distribution, and profound uncertainty as to risk related to the relative lack of population monitoring in California, contributed to NMFS' conclusion for CC Chinook salmon are at risk of becoming endangered in the foreseeable future throughout all or a significant portion of their range (64 FR 50394, September 16, 1999; Williams *et al.* 2011).

Williams *et al.* (2011) found that historical and current information indicates that CC Chinook salmon populations are depressed in basins where they are being monitored. Uncertainty about abundance, natural productivity, introduction of hatchery fish, and distribution continues to substantially contribute to risks facing this ESU. Concerns about current abundances relative to historical abundances, mixed trends in the few time series available, and potential extirpations in the southern part of the range contributed to the conclusion that CC Chinook salmon are likely to become endangered in the foreseeable future (Williams *et al.* 2011).

Several years of sampling in Chadd Creek have failed to detect Chinook salmon presence (CDFG 2005, 2011), which is likely due to Chinook salmon emigrating before summer low flow conditions. Therefore, NMFS does not expect that CC Chinook salmon will occupy the action area during project implementation, and concludes the project is not likely to adversely affect CC Chinook salmon. As a result, CC Chinook salmon are not considered further in this Opinion.

2. NC Steelhead

*a. Life History*

Steelhead probably have the most diverse life history of any salmonid (Quinn 2005). There are two basic steelhead life history patterns, winter-run and summer-run (Moyle 2002, Quinn 2005). Winter-run steelhead enter rivers and streams from December to March in a sexually mature state and spawn in tributaries to mainstem rivers, often ascending long distances. Summer steelhead (also known as spring-run steelhead) enter rivers in a sexually immature state during receding flows of spring and migrate to headwater reaches of tributary streams where they hold in deep pools until spawning the following winter or spring (Moyle 2002). Spawning for all runs generally takes place in the late winter or early spring. Eggs hatch in 3 to 4 weeks and fry emerge from the gravel 2 to 3 weeks later (Moyle 2002). Juveniles spend 1 to 4 years in freshwater before migrating to estuaries and the ocean where they spend 1 to 3 years before returning to spawn. "Half pounder" steelhead are sexually immature steelhead that spend about 3 months in estuaries or the ocean before returning to lower river reaches on a feeding run (Moyle 2002). Then they return to the ocean where they spend 1 to 3 years before returning to freshwater to spawn. Unlike Pacific salmon, steelhead are capable of spawning more than once before death (Busby *et al*. 1996). However, it is rare for steelhead to spawn more than twice before dying; most that do so are females (Busby *et al.* 1996). Some steelhead "residualize," becoming resident rainbow trout and never adopt the anadromous life history.

*b. Current Distribution and Abundance*

Along the eastern Pacific, rainbow trout, including steelhead, are distributed from Southern California north to Alaska and range west to Siberia (Sheppard 1972). In California, steelhead occur in coastal streams from the Oregon border down to San Diego County and inland to barriers to migration throughout their distribution. The NC steelhead DPS includes all naturally spawning populations of steelhead in California coastal river basins from Redwood Creek, Humboldt County to just south of the Gualala River, Mendocino County (Spence *et al*. 2007). This distribution includes the Eel River, the third largest watershed in California. Spence *et al.* (2007) identified 32 historically self-sustaining populations in the DPS region based on habitat availability and gene flow among watersheds. An additional 33 small populations are likely dependent upon immigration of non-natal steelhead from the more permanent populations (Bjorkstedt *et al*. 2005). With few exceptions, NC steelhead are present wherever streams are accessible to anadromous fishes and have sufficient flows. Big and Stone lagoons, between Redwood Creek and Little River, contain steelhead following natural breaching of the lagoons in the early winter, although the source of these fish is unknown (M. Sparkman, pers. comm., 2007; Moyle *et al*. 2008).

Quantitative information on NC steelhead is scarce, but there are a few survey index estimates of stock trends. Most data come from fish counts from the 1930s and 1940s at three dams: Sweasey Dam on the Mad River (annual adult average 3,800 in the 1940s), Cape Horn Dam on the upper Eel River (4,400 annual average in the 1930s), and Benbow Dam on the South Fork Eel River (18,784 annual average in the 1940s; Murphy and Shapovalov 1951 *op. cit.*, Shapovalov and Taft 1954, Busby *et al.* 1996). These data can be compared to the annual average at Sweasey Dam of 2,000 steelhead in the 1960s, annual average at Cape Horn Dam in the 1980s at 1,000, and annual average at Benbow Dam of 3,355 steelhead in the 1970s

(McEwan and Jackson 1996, Busby *et al.* 1996). In the mid-1960s, CDFG estimated the number of steelhead spawning in many rivers in the DPS area to total about 198,000 adults (McEwan and Jackson 1996).

The most abundant run is thought to be in the Middle Fork Eel River, with about 2,000 fish in 1996 (McEwan and Jackson 1996). Substantial declines from historic levels at major dams indicate a probable decline from historic levels at the DPS scale. Adams (2000) concluded that the status of the population had changed little since the 1996 status review. Based on the declining abundance and the inadequate implementation of conservation measures, NMFS concluded that the NC steelhead ESU warranted listing as a threatened species (65 FR 36074, June 7, 2000).

Williams *et al.* (2011) found that historical and current information indicates that NC steelhead populations are depressed in basins where they are being monitored. Williams *et al*. (2011) concluded, albeit with limited data: (1) population abundances are low, compared to historical estimates; (2) recent trends are downward, although not significantly, (3) summer-run steelhead abundance remains low, and (4) in the Mad River, the high number of hatchery fish in the basin, coupled with the uncertainty about the relative abundance of hatchery and wild spawners is of concern. Lack of data on run sizes within the DPS was a major source of uncertainty in the Williams *et al.* (2011) assessment.

3. SONCC Coho Salmon

*a. Life History*

Adult coho salmon reach sexual maturity at 3 years of age, and die after spawning. Precocious 2 year olds, especially males, also make up a small percentage of the spawning population. Coho salmon adults migrate and spawn in small streams that flow directly into the ocean, or tributaries and headwater creeks of larger rivers (Sandercock 1991, Moyle 2002). Adults migrate upstream to spawning grounds from September through late December, with the run peaking in October and November. Spawning occurs mainly in November and December, with fry emerging from the gravel in the spring, approximately 3 to 4 months after spawning. Juvenile rearing usually occurs in tributary streams with a gradient of 3 percent or less, although they may move up to streams of 4 percent or 5 percent gradient. Juveniles have been found in streams as small as 1 to 2 meters wide. Juvenile coho salmon may spend 1 to 2 years rearing in freshwater (Bell and Duffy 2007), or emigrate to an estuary shortly after emerging from spawning gravels (Tschaplinski 1988). Coho salmon juveniles are also known to redistribute into non-natal rearing streams, lakes, or ponds, often following rainstorms, where they continue to rear (Peterson 1982). At a length of 38 to 45 mm, fry may migrate upstream a considerable distance to reach lakes or other rearing areas (Godfrey 1965 *op. cit.* Sandercock 1991, Nickelson *et al.* 1992). Emigration from streams to the estuary and ocean generally takes place from March through May.

*b. Current Distribution and Abundance*

Reliable current time series of naturally produced adult migrants or spawners are not available for SONCC coho salmon ESU rivers (Good *et al*. 2005). For a summary of historical and current distributions of SONCC coho salmon in northern California, refer to CDFG's (2002)

coho salmon status review, historical population structure by Williams *et al.* (2006), as well as the presence and absence update for the northern California portion of the SONCC coho salmon ESU (Brownell *et al.* 1999). Williams *et al.* (2011) concluded that SONCC coho salmon were likely to become endangered in the foreseeable future, which is consistent with an earlier assessment (Weitkamp *et al.* 1995). Although there are few data, the information that is available for SONCC coho salmon indicates the component populations are in decline and strongly suggests the ESU is at risk of extinction (Weitkamp *et al.* 1995, CDFG 2002, Williams *et al.* 2011). Williams *et al.* 2011 concluded that the most recent population trend data for SONCC coho salmon show a continued downward trend throughout most of the SONCC coho salmon ESU.

The main stocks in the SONCC coho salmon ESU (Rogue, Klamath, and Trinity rivers) remain heavily influenced by hatcheries and have little natural production in mainstem rivers (Weitkamp *et al.* 1995, Williams *et al.* 2011). The listing of SONCC coho salmon includes all hatchery-produced coho salmon in the ESU range (70 FR 37160, June 28, 2005). Trinity River Hatchery maintains high production, with a significant number of hatchery coho salmon straying into the wild population (NMFS 2001). The Mad River Hatchery ceased coho salmon production in 1999 and Iron Gate Hatchery has reduced production in recent years to a production goal of 75,000 juveniles. The apparent decline in wild production in these rivers, in conjunction with significant hatchery production, suggests that natural populations of coho salmon are not self-sustaining (Weitkamp *et al.* 1995, Good *et al.* 2005). Coho salmon populations continue to be depressed relative to historical numbers, and there are strong indications that breeding groups have been lost from a significant percentage of streams within their historical range (Williams *et al.* 2011).

Brown *et al.* (1994) estimated that the rivers and tributaries in the California portion of the SONCC coho salmon ESU produced an average of 7,080 naturally spawning coho salmon and 17,156 hatchery returns, including 4,480 "native" fish occurring in tributaries having little history of supplementation with nonnative fish. Combining the California run-size estimates with Rogue River estimates, Weitkamp *et al.* (1995) arrived at a rough minimum run-size estimate for the SONCC coho salmon ESU of about 10,000 natural fish and 20,000 hatchery fish.

Brown and Moyle (1991) suggested that naturally spawned adult coho salmon runs in California streams were less than one percent of their abundance at mid-twentieth century, and estimated that wild coho salmon populations in California did not currently exceed 100 to 1,300 individuals. CDFG (1994) summarized most information for the northern California portion of the ESU, and concluded that "coho salmon in California, including hatchery stocks, could be less than 6 percent of their abundance during the 1940s, and have experienced at least a 70 percent decline in numbers since the 1960s." Further, CDFG (1994) reported that coho salmon populations have been virtually eliminated in many streams, and that adults are observed only every third year in some streams, suggesting that two of three brood cycles may have already been eliminated.

Scientists at the NMFS Southwest Fisheries Science Center compiled a presence-absence database for the SONCC coho salmon ESU similar to that developed by CDFG (Good *et al.* 2005). The data set includes information for coho salmon streams listed in Brown and Moyle

(1991), as well as other streams that NMFS found historical or recent evidence of coho salmon presence. The database is a composite of information contained in the NMFS (2001) status review update, additional information gathered by NMFS since publication of the 2001 status review, data used in the CDFG (2002) analysis, and additional data compiled by CDFG for streams not on the Brown and Moyle (1991) list. Using the NMFS database, Good *et al.* (2005) compiled information on the presence of coho salmon in streams throughout the SONCC ESU (figure 4-1), which closely matched the results of Brown and Moyle (1991).

Annually, the estimated percentage of streams in the SONCC coho salmon ESU for which coho salmon presence was detected generally fluctuated between 36 percent and 61 percent between brood years 1986 and 2000 (Figure 1). Data reported for the 2001 brood year suggest a strong year class, as indicated by an occupancy rate of more than 75 percent; however, the number of streams for which data were reported was small compared to previous years. The data suggest that, for the period of record, occupancy rates in the SONCC coho salmon ESU were highest (54 to 61 percent) between brood years 1991 and 1997, then declined between 1998 and 2000 (39 to 51 percent) before rebounding in 2001. However, the number of streams surveyed in 2001 was roughly 25 percent of the number surveyed in previous years (Good *et al*. 2005). For a discussion of the current viability of the SONCC coho salmon ESU, please see the *Viability of the ESU/DPS* section.

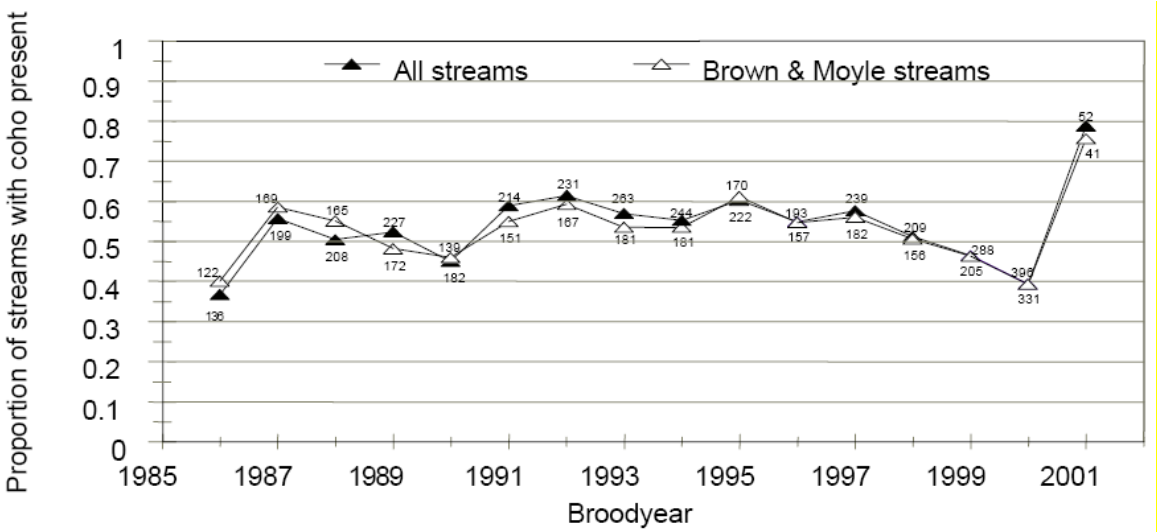


**Figure 1.** Proportion of surveyed streams where coho salmon were detected (Good *et al*. 2005). The number of streams surveyed is shown next to data.

## B. Factors Responsible for Salmonid Decline (ESU or DPS Scale)

The factors that have caused declines in the SONCC coho salmon ESU and NC steelhead DPS are similar. Factors responsible for decline include habitat loss due to dam building, degradation of freshwater habitats due to a variety of agricultural and forestry practices, water diversions, urbanization, mining, and severe recent flood events, which were exacerbated by land use practices (Good *et al.* 2005). Sedimentation and loss of spawning gravels associated with poor forestry practices and road building are particularly acute problems that can reduce the productivity of salmonid populations. Invasive Sacramento pikeminnow (*Ptychocheilus grandis*)

occupy the Eel River basin and prey on juvenile salmonids (Good *et al.* 2005) and compete for the same resources as well. Droughts and unfavorable ocean conditions in the late 1980s and early 1990s were identified as further likely causes of decline (Good *et al.* 2005).

1. Timber Harvest

Timber harvest and associated activities have occurred and continue to occur over a large portion of the range of the affected species. Timber harvest caused widespread increases in sediment delivery to channels through both increased landsliding and surface erosion from harvest units log decks, and logging roads. Much of the riparian vegetation was removed, reducing future sources of LWD needed to form and maintain stream habitat that salmonids depend on during various life stages.

Road construction, use, and maintenance, tree-felling, log hauling, slash disposal, site preparation for replanting, and soil compaction by logging equipment are all potential sources of fine sediment (Hicks *et al.* 1991, Murphy 1995). The potential for sediment delivery to a stream increases as hillslope gradients increase (Murphy 1995). The soils in virgin forests generally resist surface erosion because their coarse texture and thick layer of organic material and moss minimize overland flow (Murphy 1995) Yarding activities that cause extensive soil disturbance and compaction can increase the potential for splash erosion and channelize overland flow. Site preparation and other actions which result in the loss of the protective humic layer can increase the potential for surface erosion (Hicks *et al.* 1991). Controlled fires can also consume downed wood that had been acting as sediment dams on hillslopes. After harvesting, root strength declines, often leading to slumps, landslides, and surface erosion (FEMAT 1993, Thomas *et al.* 1993). Riparian tree roots provide bank stability and streambank sloughing and erosion often increases if these trees are removed, leading to increases in sediment and loss of overhanging banks, which are important habitat for rearing Pacific salmonids (Murphy 1995). Where rates of timber harvest are high, the effects of individual harvest units on watercourses are cumulative. Therefore, in sub-watersheds where timber harvest is concentrated in a relatively short period of time, we expect that fine sediment delivery and associated degradation of the channel and salmonid habitat will be similarly concentrated.

In smaller streams, recruited wood usually cannot be transported by stream flows, so logs remain in place and act as check-dams that store sediment eroded from hillsides (Reid 1998). Sediment storage in smaller streams can persist for decades (Nakamura and Swanson 1993). In assessing the characteristics of Class III watercourses, Simpson Resource Company (2002) found that coniferous woody debris was the predominant channel bed grade control. Furthermore, woody debris and adjacent riparian stands can provide roughness that limit the distance debris flows may travel down channels, and also functions to store and meter out sediment (Ketcheson and Froehlich 1978, Pacific Watershed Associates (PWA) 1998). For example, in Bear Creek, a tributary to the Eel River, PWA (1998) noted that debris flows now travel farther downstream and channel aggradation extends farther downstream because timber harvest reduced the amount of potential LWD from landslide source areas or streamside areas.

On larger channels, wood again stores sediment, and also provides a critical element in the habitat of aquatic life forms (Spence *et al.* 1996, Reid 1998). Sullivan *et al.* (1987) found that woody debris forms abundant storage sites for sediment in forest streams as large as fourth-order

(20 to 50 $km^2$ drainage area), where storage is otherwise limited by steep gradients and confinement of channels between valley walls. Studies of this storage function in Idaho by Megahan and Nowlin (1976) and in Oregon by Swanson and Lienkamper (1978) indicated that annual sediment yields from small forested watersheds are commonly less than 10 percent of the sediment stored in channels.

In fish-bearing streams, large wood is also important for storing sediment, reducing habitat degradation from debris flows, storing water which results in muted flood peaks, and its role as a habitat element becomes directly relevant for Pacific salmon species (Reid 1998). LWD alters the longitudinal profile and reduces the channel gradient, especially when log dams create slack pools above or plunge pools below them, or when they are sites of sediment accumulation (Swanston 1991).

Cumulatively, increased sediment delivery and reduced supply of large woody debris has led to widespread negative effects to stream habitats and salmonids. These effects include reduced spawning habitat quality, loss of pool habitat for adult holding and juvenile rearing, loss of velocity refugia, and increases in the levels and duration of turbidity, which reduces the ability of juvenile fish to feed and, in some cases, may cause physical harm by abrading the gills of individual fish. These changes in habitat have led to widespread decreases in the carrying capacity of streams that support salmonids which will decrease the likelihood of the recovery of NC steelhead and SONCC coho salmon at the ESU or DPS scales.

2. Road Construction, Use, and Maintenance

Road construction has caused widespread negative effects to salmonids (Furniss *et al.* 1991). Where roads cross salmonid-bearing streams, improperly placed culverts have eliminated or reduced salmonid access to miles of stream habitat. Landslides and chronic or acute road surface erosion are large sources of sediment across the affected species' ranges. Roads with inboard ditches increase peak flows, resulting in channel instability and habitat degradation and reduced summer base flows; thereby reducing summer rearing habitat. Roads have led to widespread impacts on salmonids by increasing the sediment loads. The consequent impacts on habitat include reductions in spawning, rearing and holding habitat, and increases in turbidity.

The delivery of road-related sediment to streams is either chronic, episodic, or both. Chronic delivery, or surface erosion, occurs through rainsplash and overland flow. Therefore, surface erosion occurs often and is associated with rainfall. More episodic delivery, on the order of every few years or more, occurs in the form of mass wasting events, or landslides, that deliver large volumes of sediment during large storms.

Construction and use of road networks greatly accelerate erosion rates within a watershed (Haupt 1959, Swanson and Dyrness 1975, Swanston and Swanson 1976, Reid and Dunne 1984, Hagans and Weaver 1987). Existing road networks are a chronic source of sediment to streams (Swanston 1991) and are generally considered the main cause of accelerated surface erosion in forests across the western United States (Harr and Nichols 1993). Processes initiated or affected by roads include landslides, surface erosion, secondary surface erosion (landslide scars exposed to rainsplash), and gullying. Roads and related ditch networks are often connected to streams via surface flow paths, providing a direct conduit for sediment and water. Where roads and ditches

are maintained periodically by blading, the amount of sediment delivered to streams may temporarily increase as bare soil is exposed and ditch roughness features which store and route sediment and also armor the ditch are removed. Hagans and Weaver (1987) found that fluvial hillslope erosion associated with roads in the lower portions of the Redwood Creek watershed produced about as much sediment as landslide erosion between 1954 and 1980. In the Mattole River watershed, which is south of the action area, the Mattole Salmon Group (1997) found that roads, including logging haul roads and skid trails, were the source of 76 percent of all erosion problems mapped in the watershed, although this figure does not specifically address road surface erosion. It does suggest that, overall, roads are a primary source of sediment in managed watersheds. Road surface erosion is particularly affected by traffic, which increases sediment yields substantially (Reid and Dunne 1984). Other important factors that affect road surface erosion include condition of the road surface, timing of when the roads are used in relation to rainfall, road prism moisture content, location of the road relative to watercourses, methods used to construct the road, the steepness on which the road is located, and if the road is insloped, outsloped, or crowned. Increased sediment delivery from roads has led to widespread decreases in the carrying capacity of streams that support salmonids which will decrease the likelihood of the recovery of of SONCC coho salmon and NC steelhead at the ESU or DPS scales.

3. Hatcheries

Hatchery operations potentially conflict with salmon recovery. Three large mitigation hatcheries (Trinity River Hatchery, Iron Gate Hatchery, Cole Rivers Hatchery) release roughly 14,215,000 hatchery salmonids into SONCC coho salmon ESU rivers annually. Additionally, a couple of smaller hatcheries, such as Mad River Hatchery and Rowdy Creek Hatchery (Smith River) produce hatchery fish. Both intra- and inter-specific interactions between hatchery and wild salmonids occur in freshwater and saltwater.

Spawning by hatchery salmon is often not controlled (ISAB 2002). Hatchery fish also stray into other rivers and streams, transferring genes from hatchery populations into naturally spawning populations (Pearse *et al.* 2007). This is thought to be problematic because hatchery programs alter the genetic composition (Reisenbichler and Rubin 1999), phenotypic traits (Hard *et al.* 2000, Kostow 2004), and behavior (Berejikian *et al.* 1996, Jonsson 1997) of hatchery-reared fish. Genetic interactions between hatchery and naturally produced stocks decrease the amount of genetic and phenotypic diversity of a species by homogenizing once disparate traits of hatchery and natural fish. The result has been progeny with lower survival (McGinnity *et al.* 2003, Kostow 2004) and ultimately, a reduction in the fitness of the natural stock (Reisenbichler and McIntyre 1997, Chilcote 2003, Araki *et al.* 2007), and outbreeding depression (Reisenbichler and Rubin 1999).

Flagg *et al.* (2000) found that, except in situations of low wild fish density, increasing releases of hatchery fish leads to displacement of wild fish from portions of their habitat. Competition between hatchery- and naturally-produced salmonids has also been found to lead to reduced growth of naturally produced fish (McMichael *et al.* 1997). Kostow *et al.* (2003) and Kostow and Zhou (2006) found that over the duration of the steelhead hatchery program on the Clackamas River, Oregon, the number of hatchery steelhead in the upper basin regularly caused the total number of steelhead to exceed carrying capacity, triggering density-dependent mechanisms that reduced the natural population. Competition between hatchery and natural

salmonids in the ocean has also been shown to lead to density-dependent mechanisms that affect natural salmonid populations, especially during periods of poor ocean conditions (Beamish *et al.* 1997a, Levin *et al.* 2001, Sweeting *et al.* 2003).

NMFS specifically identified the past practices of the Mad River Hatchery as potentially damaging to NC steelhead. CDFG out-planted non-indigenous Mad River Hatchery brood stocks to other streams within the ESU, and attempted to cultivate a run of non-indigenous summer steelhead within the Mad River. CDFG ended these practices in 1996. The currently operating Mad River Hatchery, Trinity River Hatchery, Iron Gate Hatchery, and Rowdy Creek Hatchery operate in areas overlapping the ESUs and DPS (in part) and have all been identified as having potentially harmful effects to wild salmon populations.

4. Water Diversions and Habitat Blockages

Stream-flow diversions are common throughout the species' ranges. Unscreened diversions for agricultural, domestic and industrial uses were a significant factor for salmonid declines in many basins. Reduced stream-flows due to diversions reduce the amount of habitat available to salmonids and can degrade water quality, such as causing water temperatures to elevate more easily. Reductions in water quantity will reduce carrying capacity of an affected stream reach. Where warm-water return flows enter a stream, fish may seek reaches with cooler water, thus increasing competitive pressures in other areas.

Habitat blockages have occurred in relation to road construction as discussed previously. However, hydropower, flood control, and water supply dams of different municipal and private entities, particularly in the Klamath Basin, have permanently blocked or hindered salmonid access to historical spawning and rearing grounds. Since 1908, the construction of the Potter Valley Project dams has blocked access to historic salmonid habitat within the Eel River watershed. As a result of migrational barriers, salmon and steelhead populations have been confined to lower elevation mainstems that historically only were used for migration and rearing. Population abundances have declined in many streams due to decreased quantity, quality, and spatial distribution of spawning and rearing habitat. Higher temperatures at these lower elevations during late-summer and fall are also a major stressor to adult and juvenile salmonids.

5. Predation

Predation was not believed to play a major role in the decline of salmon populations; however, it may have had substantial impacts at local levels. For example, Higgins *et al.* (1992) and CDFG (1994) reported that Sacramento River pikeminnow were observed in the Eel River basin and are considered a major threat to native salmonids (this is discussed further in the *Environmental Baseline* section). Furthermore, populations of California sea lions and Pacific harbor seals, known predators of salmonids that occur in most estuaries and rivers where salmonid runs occur on the West Coast, have increased to historical levels because harvest of these animals has been prohibited by the Marine Mammal Protection Act of 1972 (Fresh 1997). However, salmonids appear to be a minor component of the diet of marine mammals (Scheffer and Sperry 1931, Jameson and Kenyon 1977, Graybill 1981, Brown and Mate 1983, Roffe and Mate 1984, Hanson 1993). In the initial rule listing the SONCC coho salmon ESU (62 FR 24588, May 6, 1997), for example, NMFS indicated that it was unlikely that pinniped predation was a significant factor in the decline of coho salmon on the west coast, although they may be a threat to existing depressed

local populations. NMFS (1997) determined that although pinniped predation did not cause the decline of salmonid populations, predation may preclude recovery of these populations in localized areas where they co-occur with salmonids (especially where salmonids concentrate or passage may be constricted). Specific areas where pinniped predation may preclude recovery cannot be determined without extensive studies.

Normally, predators play an important role in the ecosystem, culling out unfit individuals, thereby strengthening the species as a whole. The increased effect of certain predators has been, to a large degree, the result of ecosystem modification. Therefore, it would seem more likely that increased predation is but a symptom of a much larger problem, namely, habitat modification and a decrease in water quantity and quality. With the decrease in quality riverine and estuarine habitats, increased predation by freshwater, avian, and marine predators will occur. Without adequate avoidance habitat (*e.g*., deep pools, estuaries, and undercut banks) and adequate migration and rearing flows, predation may play a role in the reduction of some salmon and steelhead populations.

6. Disease

Relative to effects of overfishing, habitat degradation, and hatchery practices, disease is not believed to have been a major cause in the decline of salmonid populations. However, disease may limit recovery of salmonid populations in some areas. Although naturally occurring, many of the disease issues salmon currently face have been exacerbated by human-induced environmental factors such as water regulation (damming and diverting) and habitat alteration.

Salmonids are exposed to numerous bacterial, protozoan, viral, and parasitic organisms in spawning and rearing areas, hatcheries, migratory routes, and the marine environment. However, disease outbreaks result only when the complex interaction among host, pathogen, and environment is altered. Natural populations of salmon have co-evolved with diseases that are endemic to the areas they inhabit and have developed levels of resistance to these pathogens. In general, diseases do not cause significant mortality in native coho salmon stocks in natural habitats (Shapovalov and Taft 1954, Bryant 1994), however, our understanding of mortality caused by pathogens in the wild is limited by the difficulty in determining the proximate and ultimate causes of death (*e.g*., when fish weakened by disease are consumed by predators). Within the last few decades, the introduction of pathogens and prevalence of disease in wild stocks has become an increasing concern. Diseases will likely continue to play some role in restricting the recovery of SONCC coho salmon and NC steelhead as long as habitat remains degraded and physiological stress compromises the immune response of individuals.

7. Fish Harvest

Salmon and steelhead once supported important tribal, commercial, and recreation fisheries. Harvest of adult salmonids for commercial and recreational fisheries has been identified as a significant factor in their decline. The proportion of harvest taken by sport and commercial fisheries has varied over the years according to abundance, social, and economic priorities. Steelhead are rarely caught in the ocean fisheries. Ocean salmon fisheries are managed by NMFS to achieve Federal conservation goals for west coast salmon in the Pacific Coast Salmon Fishery Management Plan (FMP). The goals specify numbers of adults that must be allowed to spawn annually, or maximum allowable adult harvest rates. In addition to the FMP goals,

salmon fisheries must meet requirements developed through NMFS intra-agency section 7 consultations.

Ocean exploitation rates have dropped substantially in response to the non-retention regulations for coho salmon put in place in 1994, as well as general reductions in Chinook salmon-directed effort. Directed river harvest of coho salmon has not been allowed within the SONCC coho salmon ESU since 1994, with the exception of sanctioned tribal harvest for subsistence, ceremonial, and commercial purposes by the Yurok, Hoopa Valley, and Karuk tribes (CDFG 2002). SONCC-origin coho salmon that migrate north of Cape Blanco experience incidental morality due to hooking and handling in this fishery; however, total incidental mortality from this fishery and Chinook salmon-directed fisheries north of Humbug Mountain has been estimated to be less than 7 percent of the total mortality of coho salmon since 1999 (PFMC 1999, 2000, 2003).

Since 1998, total fishery harvest rates have been limited to no more than 13 percent on Rogue/Klamath hatchery coho salmon (surrogate stock) and no retention of coho salmon in California ocean fisheries. Only marked hatchery coho salmon are allowed to be harvested in the Rogue and Klamath Rivers. All other recreational coho salmon fisheries in the Oregon portion of the ESU are closed. Recovery management may last more than 10 years even with no fishery impacts due to loss or deterioration of significant portions of freshwater habitat and ongoing unfavorable marine conditions.

Coho salmon harvested by Native American tribes is primarily incidental to larger Chinook salmon subsistence fisheries in the Klamath and Trinity rivers. In neither basin was tribal harvest considered to be a major factor in the decline of coho salmon. The Yurok fishery has been monitored since 1992, and has resulted in annual harvest that ranged from 27 to 1,168 fish. Based on estimates of upstream escapement (in-river spawners and hatchery returns) this fishery is thought to amount to an average harvest rate of 4.4 percent for the period (CDFG 2004). Harvest management practiced by tribes is conservative and has resulted in limited impacts on stocks.

The commercial and recreational ocean fisheries for salmon and steelhead were closed in 2008 due to record low returns of Sacramento River fall-run Chinook salmon and were extended through the 2009-2010 fishing season. The only exception to the 2009-2010 closure was a 10-day recreational ocean salmon season along the northern California coast targeting Klamath River fall-run Chinook salmon, due to projected spawner estimates surpassing conservation goals. The closure of the commercial and recreational fisheries is believed to decrease incidental take of listed salmonids, and therefore assist in their recovery.

8. Climate Change

Climate change is postulated to have a negative impact on salmonids throughout the Pacific Northwest due to anticipated large reductions in available freshwater habitat (Battin *et al.* 2007). Widespread declines in springtime snow water equivalent (SWE), which is the amount of water contained in the snowpack, have occurred in much of the North American West since the 1920s, especially since mid-century (Knowles and Cayan 2004, Mote 2006). This decrease in SWE can be largely attributed to a general warming trend in the western United States since the early

1900s (Mote *et al.* 2005, Regonda *et al.* 2005, Mote 2006), even though there have been modest upward precipitation trends in the western United States since the early 1900s (Hamlet *et al.* 2005). The largest decreases in SWE are taking place at low to mid elevations (Mote 2006, Van Kirk and Naman 2008) because the warming trend overwhelms the effects of increased precipitation (Hamlet *et al.* 2005, Mote *et al.* 2005, Mote 2006). These climactic changes have resulted in earlier onsets of springtime snowmelt and streamflow across western North America (Hamlet and Lettenmaier 1999, Regonda *et al.* 2005, Stewart *et al.* 2005), as well as lower flows in the summer (Hamlet and Lettenmaier 1999, Stewart *et al.* 2005).

The projected runoff-timing trends over the course of the twenty first century are most pronounced in the Pacific Northwest, Sierra Nevada, and Rocky Mountain regions, where the eventual temporal centroid of streamflow (*i.e.*, peak streamflow) shifts 20 to 40 days earlier in many streams (Stewart *et al.* 2005). Although climate models diverge with respect to future trends in precipitation, there is widespread agreement that the trend toward lower SWE and earlier snowmelt will continue (Zhu *et al*. 2005, Vicuna *et al*. 2007). Thus, availability of water resources under future climate scenarios is expected to be most limited during the late summer (Gleick and Chalecki 1999, Miles *et al*. 2000). A one-month advance in timing centroid of streamflow would also increase the length of the summer drought that characterizes much of western North America, with important consequences for water supply, ecosystem, and wildfire management (Stewart *et al.* 2005). These changes in peak streamflow timing and snowpack will negatively affect salmonid populations due to habitat loss associated with lower water flows, higher stream temperatures, and increased human demand for water resources.

The global effects of climate change on river systems and salmon are often superimposed upon the local effects of logging, water utilization, harvesting, hatchery interactions, and development within river systems (Bradford and Irvine 2000, Mayer 2008, Van Kirk and Naman 2008). For example, total water withdrawal in California, Idaho, Oregon and Washington increased 82 percent between 1950 and 2000, with irrigation accounting for nearly half of this increase (MacKichan 1951, Hutson *et al.* 2004), while during the same period climate change was taking place. Therefore, changes in climate are likely affecting the resilience and recovery of salmonid habitats and consequent threatened status of SONCC coho salmon and NC steelhead.

9. Ocean Conditions

Variability in ocean productivity has been shown to affect fisheries production both positively and negatively (Chavez *et al.* 2003). Beamish and Bouillion (1993) showed a strong correlation between North Pacific salmon production and marine environmental factors (*e.g*., copepod production and the Aleutian Low Pressure Index) from 1925 to 1989. Beamish *et al.* (1997b) noted decadal-scale changes in the production of Fraser River sockeye salmon that they attributed to changes in the productivity of the marine environment. Warm ocean regimes are characterized by lower ocean productivity (Behrenfeld *et al.* 2006, Wells *et al.* 2006), which may affect salmon by limiting the availability of nutrients regulating the food supply, thereby increasing competition for food (Beamish and Mahnken 2001). Data from across the range of coho salmon on the coast of California and Oregon reveal there was a 72 percent decline in returning adults in 2007/08 compared to the same cohort in 2004/05 (MacFarlane *et al.* 2008). The Wells Ocean Productivity Index, an accurate measure of Central California ocean productivity, revealed poor conditions during the spring and summer of 2006, when juvenile

coho salmon and Chinook salmon from the 2004/05 spawn entered the ocean (McFarlane *et al.* 2008). Data gathered by NMFS suggest that strong upwelling in the spring of 2007 may have resulted in better ocean conditions for the 2007 coho salmon cohort (MacFarlane *et al.* 2008). The quick response of salmonid populations to changes in ocean conditions (MacFarlane *et al.* 2008) strongly suggests that density dependent mortality of salmonids is a mechanism at work in the ocean (Beamish *et al.* 1997a, Levin *et al.* 2001, Greene and Beechie 2004). Long-term declines in the status of SONCC coho salmon and NC steelhead are likely tied to decadal or longer changes in ocean productivity.

10. Marine Derived Nutrients

Marine-derived nutrients (MDN) are nutrients and carbon that accumulate in the biomass of salmonids while they are feeding in the ocean, and are then transferred to streams when salmon return to spawn and die. The return of salmonids to rivers makes a significant contribution to the flora and fauna of both terrestrial and riverine ecosystems (Gresh *et al.* 2000), and has been shown to be vital for the growth of juvenile salmonids (Bilby *et al.* 1996, 1998). Fisheries, hatcheries, and collapsed populations result in a reduction in the amount of marine-derived nutrients in streams ecosystems. Evidence of the role of MDN and energy in ecosystems suggests this deficit may result in an ecosystem failure contributing to the downward spiral of salmonid abundance (Bilby *et al.* 1996). Reduction of MDN to watersheds is a consequence of the past century of decline in salmon abundance (Gresh *et al.* 2000) and is likely contributing to continued low population abundance and the threatened status of SONCC coho salmon and NC steelhead.

## C. Viability of the ESU/DPS

An ESU or DPS is made up of multiple populations. The viability of an ESU or DPS can be assessed by considering the viability of its component populations, and the effects of a proposed action on an ESU or DPS can be assessed by first considering the effects of the proposed action on its component populations. To integrate population information into viability criteria at the ESU/DPS scale, NMFS has identified "diversity strata," which are "groups of populations that span the diversity and distribution that currently exists or historically existed within an ESU" (Bjorkstedt *et al.* 2005). Diversity strata account for the important variability that exists in environments and in the physical characteristics and genetic makeup of salmonids. Bjorkstedt *et al.* (2005) and Williams *et al*. (2006) provide a set of rules that are expected to result in certain configurations of populations within each diversity stratum that they believe will result in a viable ESU. A population is part of a particular diversity stratum, which is part of a particular ESU or DPS. The ESU or DPS cannot be considered viable unless all its diversity strata are viable, and each diversity stratum cannot be considered viable unless its populations meet the criteria described by Bjorkstedt *et al.* (2005) and Williams *et al.* (2006). A diversity stratum could be considered viable even if one or more of its component populations were not viable, if the remaining populations met all the viability characteristics including, abundance, productivity, diversity, and spatial structure (McElhany *et al.* 2000, Bjorkstedt *et al*. 2005, Williams *et al*. 2006).

In this Opinion the current viability of the Chadd Creek populations of coho salmon and steelhead is discussed in the *Environmental Baseline*. Then the effects of the project on the viability of the Chadd Creek populations of coho salmon and steelhead will be assessed in the

*Effects of the Action* section. Finally, the implications for viability of the ESU and DPS will be analyzed in the *Integration and Synthesis* section.

In order to determine the current viability of each ESU or DPS, we use the concept of a Viable Salmonid Population (VSP) and its parameters for evaluating populations (McElhany *et al.* 2000). The four parameters are population size, productivity, spatial structure, and diversity. Each parameter is described below, followed by an assessment of the viability of each parameter for each ESU or DPS which may be affected by the project.

1. Population Size

Population size provides an indication of the risk of extinction that a population faces. For instance, smaller populations may be at a greater risk of extinction than large populations, primarily because the processes that affect populations may operate differently in small populations than in large populations (McElhany *et al.* 2000). For example, one risk of low population size is depensation. Depensation occurs when populations are reduced to very low densities and per capita growth rates decrease as a result of a variety of mechanisms [*e.g.*, failure to find mates and therefore reduced probability of fertilization, failure to saturate predator populations (Liermann and Hilborn 2001)]. Depensation results in a negative feedback that accelerates a decline toward extinction (Williams *et al.* 2008).

Data for SONCC coho salmon and NC steelhead are insufficient to set specific numeric population size targets for viability (Spence *et al.* 2007, Williams *et al.* 2008). In the absence of such targets, McElhany *et al.* (2000) suggested ESUs, ". . . have been historically self-sustaining and the historical number and distribution of populations serves as a useful 'default' goal in maintaining viable ESUs [or DPS']."

*a. NC Steelhead*

Reviewers participating in the most recent status review determined population abundances continue to be depressed relative to historical estimates, and that summer-run steelhead abundance was very low (Williams *et al.* 2011). NMFS concludes this DPS falls far short of McElhany *et al.*'s (2000) default goal of historic population numbers and distribution and is therefore not viable in regards to population size (abundance, Williams *et al.* 2011).

*b. SONCC Coho Salmon*

NMFS 2005 status review concluded SONCC coho salmon populations ". . . continue to be depressed relative to historical numbers, and [there are] strong indications that breeding groups have been lost from a significant percentage of streams within their historical range (Good *et al.* 2005)." NMFS concludes this ESU falls far short of McElhany *et al.*'s (2000) default goal of historic population numbers and distribution and is therefore not viable in regards to the population size VSP parameter (Williams *et al.* 2011).

Since the 2005 review, the apparent negative trends in adult abundance across the ESU are of great concern, as is the lack of information necessary to determine if there has been a substantial improvement in freshwater habitat and survival of individuals. However, these recent negative trends must be considered in the context of the apparent extremely low marine survival rates over the past five years that most likely contributed to the observed declines. Overall, this new

information, while cause for concern, does not appear to indicate there has been a change in biological extinction risk since the last status review (Williams *et al.* 2011).

2. Population Productivity

The productivity (growth) of a population (*i.e*., the number of individuals generated over a specified time interval) can reflect conditions (*e.g*., environmental conditions) that influence the dynamics of a population and determine abundance. In turn, the productivity of a population allows an understanding of the performance of a population across the landscape and habitats in which it exists and its response to those habitats (McElhany *et al.* 2000). Productivity is generally measured as the ability of a population to replace itself (i.e., spawner to recruit ratio). In the status reviews for the SONCC coho salmon ESU and the NC steelhead DPS, NMFS concluded the data were insufficient to set specific numeric population productivity targets for viability (Spence *et al.* 2007, Williams *et al.* 2008). McElhany *et al.* (2000) suggested a population's natural productivity should be sufficient to maintain its abundance above the viable level. This guideline seems a reasonable goal in the absence of numeric population productivity targets.

*a. NC Steelhead*

As described previously, populations of NC steelhead have declined substantially from historic levels. As productivity does not appear sufficient to maintain viable abundances in many NC steelhead populations, NMFS concludes this DPS is not viable in regards to population productivity (Williams *et al.* 2011).

*b. SONCC Coho Salmon*

As described previously, populations of SONCC coho salmon have declined substantially from historic levels. As productivity does not appear sufficient to maintain viable abundances in many SONCC coho salmon populations, NMFS concludes this ESU is not viable in regards to population productivity (Williams *et al.* 2011).

3. Spatial Structure

The spatial structure of a population is important because the population structure can affect evolutionary processes and, therefore, alter the ability of a population to adapt to spatial or temporal changes in the species' environment (McElhany *et al*. 2000). Status reviews for the SONCC coho salmon ESU and the NC steelhead DPS concluded data were insufficient to set specific population spatial structure targets (Spence *et al.* 2007, Williams *et al.* 2008). In the absence of such targets, McElhany *et al.* (2000) suggested: "as a default, historic spatial processes should be preserved because we assume that the historical population structure was sustainable but we do not know whether a novel spatial structure will be."

*a. NC Steelhead*

Experts consulted during the 2005 status review gave this DPS a mean risk score of 2.2 (out of 5) for the spatial structure and connectivity VSP category (Good *et al.* 2005), indicating it is unlikely this factor contributes significantly to risk of extinction by itself, but there is some concern that it may, in combination with other factors. Complete barriers to steelhead passage exist on two major rivers in the DPS and on numerous small tributaries (Good *et al.* 2005). These blockages reduce the spatial structure and connectivity of populations within the DPS. As

the default historic spatial processes described by McElhany *et al.* (2000) have likely not been preserved, NMFS concludes this DPS is not viable in regards to spatial structure.

*b. SONCC Coho Salmon*

Low levels of observed presence in historically occupied coho salmon streams (32 to 56 percent from 1986 to 2000) indicate continued low abundance in the California portion of the SONCC coho salmon ESU. The relatively high occupancy rate of historical streams observed in brood year 2001 suggests that much habitat remains accessible to coho salmon (70 FR 37160, June 28, 2005). Brown *et al*. (1994) summarized survey information on 115 streams within the SONCC coho salmon ESU, of which 73 (64 percent) still supported coho salmon runs while 42 (36 percent) did not. The streams Brown *et al*. (1994) identified as presently lacking coho salmon runs were all tributaries of the Klamath River and Eel River basins. The Biological Review Team (BRT) was also concerned about the loss of local populations in the Trinity, Klamath, and Rogue river basins (70 FR 37160, June 28, 2005). CDFG (2002) reported a decline in SONCC coho salmon occupancy, with the estimated percent reduction dependent on the data sets used. Although there is considerable year-to-year variation in estimated occupancy rates, it appears that there has been no dramatic change in the percent of coho salmon streams occupied from the late 1980s and early 1990s to 2000 (Good *et al*. 2005). In summary, recent information for SONCC coho salmon indicates that their distribution within the ESU has been reduced and fragmented, as evidenced by an increasing number of previously occupied streams from which they are now absent (Williams *et al.* 2011). However, extant populations can still be found in all major river basins within the ESU (70 FR 37160, June 28, 2005).

Experts consulted during the 2005 status review gave this ESU a mean risk score of 3.1 (out of 5) for the spatial structure and connectivity VSP category (Good *et al.* 2005), indicating its current spatial structure contributes significantly to long-term risk of extinction but does not in itself constitute a danger of extinction in the near future. Williams *et al.* (2011) concluded that the spatial structure of the SONCC coho salmon ESU continues to degrade. As the historic spatial processes described by McElhany *et al.* (2000) have not been preserved and are likely degrading, NMFS concludes this ESU is not viable in regards to spatial structure.

4. <u>Diversity</u>

Diversity, both genetic and behavioral, is critical to success in a changing environment. Salmonids express variation in a suite of traits, such as anadromy, morphology, fecundity, run timing, spawn timing, juvenile behavior, age at smolting, age at maturity, egg size, developmental rate, ocean distribution patterns, male and female spawning behavior, and physiological and molecular genetic characteristics. The more diverse these traits (or the more these traits are not restricted), the more diverse a population is, and the more likely that individuals, and therefore the species, would survive and reproduce in the face of environmental variation (McElhany *et al.* 2000). However, when this diversity is reduced due to loss of entire life history strategies *(e.g*., loss of summer-run NC steelhead and spring-run CC Chinook salmon), or to loss of unique habitat that provides variation in life history traits, the species is less able to survive and reproduce.

Genetic variability of wild stocks is naturally altered by individuals straying from natural populations in nearby streams, which results in gene flow and often sustains or even increases

the genetic diversity of a population. Straying is a normal and important part of the life history and evolution of Pacific salmon (Quinn 2005), but human activities can increase the rate of straying and cause more genetic interaction between populations than would naturally occur. Founding hatchery populations with broodstock from outside the watershed can make straying more common, as seen in the Columbia River (Pascual *et al*. 1995). Therefore, the genetic makeup of hatchery steelhead from the Mad River could detrimentally affect steelhead in many other rivers within and even outside the geographic range of the NC steelhead DPS. Excessive straying can also be detrimental to wild fish populations born in their natal streams. When habitat becomes degraded, or inaccessible due to dams or road crossings, salmonid spatial distribution can become fragmented. In this situation, straying into non-natal streams is likely to increase when salmonids are denied access to their natal areas and are forced to enter other streams that are accessible. Increased stray rates would be expected to reduce population viability, particularly if the strays are accessing unsuitable habitat or are mating with genetically unrelated individuals (McElhany *et al*. 2000).

Status reviews for the SONCC coho salmon ESU and the NC steelhead DPS concluded data were insufficient to set specific numeric diversity targets (Spence *et al.* 2008, Williams *et al.* 2008). McElhany *et al.* (2000) suggested the following in the absence of specific targets for diversity: "Historically, salmonid populations were generally self-sustaining, and the historical representation of phenotypic diversity serves as a useful 'default' goal in maintaining viable populations."

*a. NC Steelhead*

Millions of steelhead from outside the DPS have been stocked into NC steelhead rivers many times since the 1970s, but trans-basin transfers and associated plantings have since ceased. Bjorkstedt *et al.* (2005) documented 39 separate releases of this kind, and many of these releases occurred over multiple years. Of particular concern was the practice of rearing Eel River-derived steelhead in the Mad River Hatchery before restocking them into the Eel River (Bjorkstedt *et al.* 2005). Over 10 years, more than one-half million yearlings were reared and released in this way. This practice may have reduced the effectiveness of adult homing to the Eel River (Bjorkstedt *et al.* 2005). In addition, the abundance of summer-run steelhead remains depressed (Williams *et al.* 2011), indicating an important part of the life history diversity in this DPS may be at risk.

Experts consulted during the 2005 status review gave this DPS a mean risk score of 2.5 (out of 5) for the diversity VSP category (Good *et al.* 2005), indicating this factor may contribute significantly to the long-term risk of extinction, but does not itself constitute a danger of extinction in the near future. In the most recent status review (Williams *et al.* 2011), the abundance and distribution of summer-run steelhead remained a key concern. The current behavioral diversity in this ESU is much reduced compared to historic levels, and the genetic diversity has been negatively affected by out of basin transfers. Thus, NMFS concludes the current genetic and behavioral diversity in this DPS is much reduced compared to historic levels, and is not viable in regards to the diversity VSP parameter.

*b. SONCC Coho Salmon*

Genetic variability is important because differing genetic traits favor a population being able to survive and reproduce even under changing environmental conditions. With regard to the SONCC coho salmon ESU, human activities (including construction of migration barriers, *e.g*., Iron Gate Dam on the Klamath River and Lewiston Dam on the Trinity River) have eliminated portions of some coho salmon populations from the ESU. In addition, runs of coho salmon within the Klamath River basin are now composed largely of hatchery fish from Iron Gate and Trinity River hatcheries.

The high hatchery production in some systems in the SONCC coho salmon ESU may mask trends in ESU population structure and pose risks to ESU diversity (70 FR 37160, June 28, 2005). NMFS determined that the Cole Rivers Hatchery, Trinity River Hatchery, and Iron Gate Hatchery coho salmon hatchery programs are part of the ESU, and that these artificially propagated stocks are no more divergent relative to the local natural populations than what would be expected between closely related natural populations within the ESU (70 FR 37160, June 28, 2005). Within the 10 historical populations that have dams, 26 percent of historical habitat is currently located upstream of the dams (Table 5 in Williams *et al*. 2007). Loss of or limiting spawning and rearing opportunities are expected to adversely affect the species' basic demographic and evolutionary processes, causing a reduced potential that the ESU can withstand environmental fluctuations. Activities that affect evolutionary processes (*e.g*., natural selection) have the potential to alter the diversity of the species.

The primary factors affecting the diversity of SONCC coho salmon appear to be the influence of hatcheries and out-of-basin introductions. In addition, some brood years have abnormally low abundance levels or may even be absent in some areas (*e.g.*, Shasta River and Scott River), further restricting the diversity present in the ESU. Experts consulted during the 2005 status review gave this ESU a mean risk score of 2.8 (out of 5) for the diversity VSP category (Good *et al.* 2005). Williams *et al.* (2011) concluded that populations have continued to decline. NMFS concludes the current phenotypic diversity in this ESU is much reduced compared to historic levels, and is not viable in regards to the diversity VSP parameter.

5. <u>Summary</u>

*a. NC Steelhead*

Based on the above descriptions of the population viability parameters, and qualitative viability criteria presented in Spence *et al.* (2007), NMFS thinks that the NC steelhead DPS is currently not viable and is at an elevated risk of extinction.

*b. SONCC Coho Salmon*

Based on the above descriptions of the population viability parameters, and qualitative viability criteria presented in Williams *et al*. (2007), NMFS thinks that the SONCC coho salmon ESU is currently not viable and is at a moderate to high risk of extinction.

## V. STATUS OF CRITICAL HABITAT

This Opinion analyzes the effects of the project on critical habitat for SONCC coho salmon (64 FR 24049, May 5, 1999), CC Chinook salmon (70 FR 52488, September 2, 2005), and NC steelhead (70 FR 52488, September 2, 2005).

Critical habitat is defined in the ESA as the specific areas within the geographical areas occupied by the species, at the time it is listed, on which are found those physical and biological features essential to the conservation of the species and which may require special management considerations or protection, or specific areas outside the geographical area occupied by the species at the time it is listed when the Secretary of Commerce or U.S. Department of the Interior, as appropriate, determines that such areas are essential for the conservation of listed species.

This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 C.F.R. 402.02, which was invalidated by *Gifford Pinchot Task Force v. USFWS*, 378 F.3d 1059 (9th Cir. 2004), amended by 387 F.3d 968 (9th Cir. 2004). Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.

The ESA defines conservation as “to use all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to the ESA are no longer necessary.” As a result, NMFS approaches its “destruction and adverse modification” determinations by examining the effects of actions on the conservation value of the designated critical habitat, that is, the value of the critical habitat for the conservation of threatened or endangered species.

### A. NC Steelhead and CC Chinook Salmon

Designated critical habitat for NC steelhead and CC Chinook salmon includes the stream channels up to the ordinary highwater line (50 CFR Part 226.211). In areas where the ordinary high-water line has not been defined pursuant to 50 CFR Part 226.211, the lateral extent is defined by the bankfull elevation. Critical habitat for NC steelhead and CC Chinook salmon in estuaries is defined by the perimeter of the water body as displayed on standard 1:24,000 scale topographic maps or the elevation of extreme high water, whichever is greater.

Critical habitat for NC steelhead was designated as occupied watersheds from the Redwood Creek watershed, south to and including the Gualala River watershed. Critical habitat for CC Chinook salmon was designated as occupied watersheds from the Redwood Creek watershed, south to and including the Russian River watershed. Humboldt Bay and the Eel River estuary are designated as critical habitat for both the NC steelhead DPS and CC Chinook salmon ESU. Some areas within the geographic range were excluded due to economic considerations or because they overlap with Indian lands (70 FR 52488, September 2, 2005).

The action area includes designated critical habitat for NC steelhead and CC Chinook salmon. In designating critical habitat for NC steelhead and CC Chinook salmon, NMFS focused on the known primary constituent elements (PCEs) essential for the conservation of each species. PCEs are those sites and habitat components that support one or more life stages, including: (1)

freshwater spawning, (2) freshwater rearing, (3) freshwater migration, (4) estuarine areas, (5) nearshore marine areas, and (6) offshore marine areas. Within the PCEs, essential elements of CC Chinook salmon and NC steelhead critical habitats include adequate (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, (10) safe passage conditions, and (11) salinity conditions (70 FR 52488, September 2, 2005).

### B. SONCC Coho Salmon

Critical habitat for the SONCC coho salmon ESU encompasses accessible reaches of all rivers (including estuarine areas and tributaries) between Cape Blanco, Oregon and Punta Gorda, California (64 FR 24049, May 5, 1999). Excluded are: (1) areas above specific dams identified in the FR notice, (2) areas above longstanding natural impassible barriers (*i.e.*, natural waterfalls in existence for at least several hundred years), and (3) tribal lands.

The action area includes designated critical habitat for SONCC coho salmon. In designating critical habitat for SONCC coho salmon, NMFS focused on the known physical and biological features within the designated area that are essential to the conservation of the species. These essential features may include, but are not limited to, spawning sites, food resources, water quality and quantity, and riparian vegetation. Within the essential habitat types (spawning, rearing, migration corridors), essential features of coho salmon critical habitat include adequate (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) safe passage conditions (64 FR 24049, May 5, 1999). The current condition of critical habitat for SONCC coho salmon is discussed in the factors affecting the species below.

### C. Conservation Value of Critical Habitat

The essential habitat types of designated critical habitat for SONCC coho salmon and PCEs of designated critical habitat for NC steelhead and CC Chinook salmon are those accessible freshwater habitat areas that support spawning, incubation and rearing, migratory corridors free of obstruction or excessive predation, and estuarine areas with good water quality and that are free of excessive predation. Timber harvest and associated activities, road construction, urbanization and increased impervious surfaces, migration barriers, water diversions, and large dams throughout a large portion of the freshwater range of the ESUs and DPS continue to result in habitat degradation, reduction of spawning and rearing habitats, and reduction of stream flows. The result of these continuing land management practices in many locations has limited reproductive success, reduced rearing habitat quality and quantity, and caused migration barriers to both juveniles and adults. These factors limit the conservation value *(i.e.*, limit the ability of the scecies to become conserved) of designated critical habitat within freshwater habitats at the ESU/DPS scale.

Watershed restoration activities have improved freshwater critical habitat conditions in some areas, especially on Federal lands. In addition, the five northern California counties affected by the Federal listing of coho salmon (which includes Humboldt County) created a 5 County Conservation Plan that establishes continuity among the counties for managing anadromous fish stocks (Voight and Waldvogel 2002). The plan identifies priorities for monitoring, assessment, and habitat restoration projects.

Although watershed restoration activities have improved freshwater critical habitat conditions in isolated areas, reduced habitat complexity, poor water quality, and reduced habitat availability as a result of past and continuing land management practices continue to exist in many locations.

## D. Current Condition of the Critical Habitat

### 1. NC Steelhead

The condition of NC steelhead critical habitat, specifically its ability to provide for their conservation, has been degraded from conditions known to support viable salmonid populations. NMFS has determined that present depressed population conditions are, in part, the result of the following human-induced factors affecting critical habitat: logging, agricultural and mining activities, urbanization, stream channelization, dams, freshwater and estuarine wetland loss, and water withdrawals for irrigation. All of these factors were identified when NC steelhead were listed as threatened under the ESA, and they all continue to affect this ESU. However, efforts to improve NC steelhead critical habitat have been widespread and are expected to increase the ability of the habitat to provide for the conservation of the species. CDFG (2010) concluded that critical habitat in the Lower Eel River basin is currently limited by high levels of fine sediments in streams, low summer flows, high summer water temperatures, a shortage of areas with suitable spawning gravel in tributaries, decreased channel capacity, lack of pool shelter and pool-forming LWD, and loss of estuarine habitat.

### 2. SONCC Coho Salmon

The condition of SONCC coho salmon critical habitat, specifically its ability to provide for their conservation, has been degraded from conditions known to support viable salmonid populations. NMFS has determined that present depressed population conditions are, in part, the result of the following human-induced factors affecting critical habitat: logging, agricultural and mining activities, urbanization, stream channelization, dams, freshwater and estuarine wetland loss, and water withdrawals for irrigation. All of these factors were identified when SONCC coho salmon were listed as threatened under the ESA, and they all continue to affect this ESU. However, efforts to improve SONCC coho salmon critical habitat have been widespread and are expected to increase the ability of the habitat to provide for the conservation of the species. Within the SONCC recovery domain, from 2000 to 2006, the following improvements were completed: 242 stream miles have been treated; 31 stream miles of instream habitat were stabilized; 41 cubic feet per second of water has been returned for instream flow; and thousands of acres of upland, riparian, and wetland habitat have been treated (NMFS 2007). Therefore, the condition of SONCC coho salmon critical habitat is likely improved or trending toward improvement compared to when it was designated in 1999. CDFG (2010) concluded that critical habitat in the Lower Eel River basin is currently limited by high levels of fine sediments in streams, low summer flows, high summer water temperatures, a shortage of areas with suitable spawning gravel in tributaries, decreased channel capacity, lack of pool shelter and pool-forming LWD, and loss of estuarine habitat.

### 3. CC Chinook Salmon

The condition of CC Chinook salmon critical habitat, specifically its ability to provide for their conservation, has been degraded from conditions known to support viable salmonid populations.

NMFS has determined that present depressed population conditions are, in part, the result of the following human-induced factors affecting critical habitat: logging, agricultural and mining activities, urbanization, stream channelization, dams, freshwater and estuarine wetland loss, and water withdrawals for irrigation. All of these factors were identified when CC Chinook salmon were listed as threatened under the ESA, and they all continue to affect this ESU. However, efforts to improve CC Chinook salmon critical habitat have been widespread and are expected to increase the ability of the habitat to provide for the conservation of the species. CDFG (2010) concluded that critical habitat in the Lower Eel River basin is currently limited by high levels of fine sediments in streams, low summer flows, high summer water temperatures, a shortage of areas with suitable spawning gravel in tributaries, decreased channel capacity, lack of pool shelter and pool-forming LWD, and loss of estuarine habitat.

4. Summary

Although watershed restoration activities have improved freshwater and estuarine critical habitat conditions in isolated areas, reduced habitat complexity, poor water quality, and reduced habitat availability as a result of historical and continuing land management practices persist in many locations and are limiting the conservation value of designated critical habitat within these freshwater and estuarine habitats at the ESU and DPS scale.

## VI. ENVIRONMENTAL BASELINE

The environmental baseline includes "the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation, and the impact of State or private actions which are contemporaneous with the consultation in process" (50 CFR 402.02). The environmental baseline provides a reference condition to which we add the effects of the project, as required by regulation ("effects of the action" at 50 CFR 402.02).

The evaluation in the *Environmental Baseline* of the current extinction risk of each population of each listed species within Chadd Creek (Table 2), and the condition and utilization of critical habitat for each species provides a reference condition for the fitness of individual fish and also at the Eel River population scale to determine if the action is expected to affect the population's risk of extinction.

**Table 2**. Population units and diversity strata of species in the action area.

| Species | Population Unit | Diversity Stratum |
|---|---|---|
| SONCC Coho salmon | Lower Eel and Van Duzen rivers | Southern Coastal |
| CC Chinook salmon | Lower Eel River | Northern Coastal |
| NC Steelhead | Lower Eel River | Northern Coastal |

In this *Environmental Baseline* section, NMFS presents information on the distribution, diversity, population abundance and population trends of the SONCC coho salmon and NC steelhead within Chadd Creek. Next, the general setting and location of the action area are described. Thirdly, a description of the historic and current impacts to watershed conditions that continue to affect salmonid populations and their designated critical habitats within the action

area is provided. Next, the conservation value of designated critical habitat within the action area is described. This information is used to describe the species' likelihood of survival and recovery, and the role that the action area plays in the overall conservation of the species and their designated critical habitats.

## A. Salmonid Distribution, Diversity, Trends and Abundance in Chadd Creek

There are no consistent salmonid monitoring data available for Chadd Creek. However, juvenile surveys conducted by CDFG in 2005 and 2011 have documented the presence of spawning and rearing steelhead and coho salmon.

### 1. Salmonid Distribution

Coho salmon and steelhead are known to spawn and rear throughout Chadd Creek. A recent culvert upgrade upstream of the action area at Highway 101 has re-established unimpaired mainstem passage for salmonids in Chadd Creek. Summer surface flows in the action area are normally very low and may be non-existent in dry years, thereby limiting the presence of juvenile coho salmon and steelhead.

### 2. Spatial Structure and Diversity

Chadd Creek has recently demonstrated successful spawning and rearing by both steelhead and coho salmon. Therefore, it serves an important role in the recovery of those populations. .

### 3. Number of Individuals and Productivity

The number of juvenile coho salmon and steelhead in Chadd Creek is unknown. However, a survey in September 2011 (CDFG 2011) resulted in a total of 145 juvenile coho salmon and 107 juvenile steelhead observed in a reach approximately one-mile upstream of the action area. Due to low flow and small footprint of the project, the number of coho salmon and steelhead in the action area would likely be very small during project implementation. NMFS expects that in wet years the action area may contain up to 50 juvenile coho salmon and 50 juvenile steelhead during project implementation.

### 4. Summary

SONCC coho salmon and NC steelhead are known to use Chadd Creek for spawning and rearing. Abundance of coho salmon and steelhead rearing in the action area will likely fluctuate depending on flow conditions.

## B. General Setting and Location

Chadd Creek is a 4.7 mile second-order stream that drains a mixture of state park, rural residential, agricultural, and managed timber lands. The drainage basin is underlain by highly erodible sedimentary soils prone to landslides. The average channel width in the action area is approximately 16 feet, and the streambed consists of cobble, gravel, and fines, typical of streams in the area. The riparian zone canopy is dominated by coastal Douglas-fir and Redwood forest, with streamside hardwoods. The staging area for heavy equipment is a road right-of-way that is predominantly open with few trees.

The concrete box culvert is undersized and causes flooding in the area during high flows. Sediment deposition occurs upstream, downstream, and within the culvert. The excess sediment reduces flow capacity of the channel. The project will excavate sediment annually during low flows to diminish the likelihood of flooding during the wet season.

## C. Historic and Current Impacts to Watershed Conditions and Salmonids in the Action Area

The stream channel within the action area is low gradient and floods overtop its banks during high-flows. Sediment enters Chadd Creek upstream of the action area from a variety of sources including, but not limited to, road networks, timber operations, residential development, and natural erosion processes (*e.g.*, landslides). The excessive accumulation of sediment in the action area contributes to flooding at the project's culvert site. The stream corridor up and downstream of the culvert has a dense, well developed, shady over-story of alders, willows, and blackberry bramble, which provide shade for fish during warm summer temperatures. The streambed is mostly composed of medium sized gravel, along with sand, silt, and fines. NMFS is unaware of water temperature data for the action area, but temperatures are presumed to be preferable for all three species of listed salmonids. The action area provides rearing habitat for juvenile salmonids and also serves as a corridor for out-migrating smolts.

### 1. Floods

Major floods in 1955 and 1964 occurred during a period of intense land use, primarily related to timber harvest (CDFG 1997), which resulted in major reductions to the quantity and quality of salmonid habitat across the action area. Floods have decreased the overall quality and complexity of habitat in Chadd Creek by causing filling of pools, erosion of riparian vegetation, and export of large woody debris.

### 2. Timber Harvest

The Chadd Creek watershed has been and is currently being affected by timber harvest. This portion of the *Environmental Baseline* provides an overview of how timber harvest has influenced watershed processes and consequently, salmonids and their habitat in the action area, by examining the following changes to the supply of large woody debris, sediment delivery, and hydrologic regime.

#### *a. Large Woody Debris*

As described more thoroughly in the *Status of the Species* section, large woody debris entering streams from adjacent uplands provides a fundamental salmonid habitat component. Wood provides areas of localized scour and deposition, thus creating pools necessary for juvenile rearing. In-stream woody debris also stores sediment, thereby moderating effects to reaches.downstream of areas with significant sediment input. Conifers provide functional and long-lasting woody debris because they are large and resistant to decay. Mature conifers and hardwoods are abundant in the riparian area upstream of the action area. Currently, there is a lack of LWD in the action area, although recruitment of wood debris to the action area will likely occur during the life of the project. .

*b. Sediment Delivery*

Erosion from upstream timber harvest activities and logging roads contribute sediment to the action area. This sediment results in decreased rearing habitat for juvenile salmonids in the action area, and will likely negatively affect habitat in the action area throughout the life of the project.

*c. Hydrologic Processes*

Timber harvest activities can have significant effects on hydrologic processes that determine streamflow. One way timber harvest and road construction alter runoff is by accelerating surface flows from hillsides to stream channels (Chamberlin *et al.* 1991).

Little is known about the magnitude of changes that have occurred to the natural hydrologic regime in Chadd Creek, but the road network in the watershed and timber harvest activities are reasonably expected to have increased peak flows. Hillslope runoff may be delivered more efficiently to receiving stream channels via gullies, roadside ditches and skid trails. Therefore, the stream may respond quicker to storm events, and rise and fall much faster than in undisturbed conditions. Increased peak flows can have adverse effects on salmonids because the increased stream power can scour stream channels, decrease aquatic invertebrate populations, and displace juvenile salmonids from winter cover (Tschaplinski and Hartman 1983).

Hydrologic conditions within the action area are directly influenced by the subject box culvert. The culvert is undersized and causes flooding in the area during high flows. Emergency in-channel work has occurred in the past to alleviate flooding at the site during high flows. This has likely resulted in increased turbidity and direct exposure to adult and juvenile salmonids. The effect of flooding on salmonids in the action area is unknown, but there is potential for stranding in upland areas.

3. Historic and Current Salmonid Fisheries

The effects of ocean harvest on salmonids were previously described in the *Status of the Species* section. Catch and release steelhead fishing occurs throughout the Eel River. However, from 2000 to 2010 no more than nine wild steelhead were taken from the entire Lower Eel River (CDFG 2012). Due to limited access, little, if any, fishing effort is believed to occur in the action area.

## D. Conservation Value of the Designated Critical Habitat

1. Listing Information

Based on the Federal Register Notices designating Critical Habitat for all three listed salmonid species, their habitat conditions are degraded relative to pristine conditions. NMFS has not previously described the conservation value of the Chadd Creek watershed. The essential habitat types of juvenile rearing areas, juvenile migration corridors, and areas for growth and development are all present in critical habitat in the Chadd Creek watershed. These habitat types provide adequate amounts of essential features of critical habitat within the watershed.

2. Description of Habitat in the Action Area

The action area, which includes the section of Chadd Creek to be excavated as well as the reach approximately 100 feet downstream of the excavation site, contains spawning, juvenile rearing, and migratory habitat for all three salmonid species. The streambed within the action area consists of cobble, gravel, and associated fines typical of streams found in the region. Riparian habitat and canopy is extremely sparse in the proposed excavation zone, but is dense upstream and downstream of the culvert.

3. Chadd Creek Baseline Summary

As previously discussed, the action area reflects a long legacy of watershed disturbances. Rural development combined with intensive upslope activities such as timber harvest and road construction, and large floods have had a significant influence on the baseline condition of the action area. Collectively, the impacts have been primarily manifested as a simplification of stream habitat with less pronounced riffles, shallower and less frequent pools, and longer, more frequent runs or flatwaters. Although recent surveys indicate an increase in salmonid abundance, this simplification of habitat continues to limit salmonid numbers in the action area by limiting habitat available for rearing. Based upon the relationships between habitat quality and the health of salmonid populations, NMFS expects the numbers of ESA-listed anadromous salmonids to remain depressed in the foreseeable future relative to historic estimates.

## VII. EFFECTS OF THE ACTION

### A. Exposure

NMFS expects that juvenile coho salmon and steelhead will be present in the action area during project implementation. Juvenile salmonids will be excluded and removed from the project work area, so they will not be directly exposed to heavy equipment operating in the wetted channel.

### B. Beneficial Effects

The removal of sediment from the work area will improve flow capacity in the stream reach, thereby diminishing the likelihood of flooding and juvenile salmonids stranding in upland areas. Emergency in-channel work has occurred in the past to alleviate flooding at the site during high flows. This has likely resulted in increased turbidity and direct exposure to adult and juvenile salmonids. Sediment excavation during the low flow season will diminish the likelihood of emergency in-channel work throughout the life of the project.

### C. Insignificant or Discountable Effects

The proposed project may produce effects, such as habitat disturbance from heavy equipment operation, chemical contamination, and reduced benthic macroinvertebrate production that are not likely to adversely affect listed species or their critical habitats. These effects are expected to be insignificant or discountable as explained below.

1. Noise, Motion, and Vibration Disturbance from Heavy Equipment Operation

Noise, motion, and vibration produced by heavy equipment operation is expected at the excavation site. However, the equipment will be staged outside the active channel and will only be used in the wetted channel after fish are removed from the area. Listed salmonids will be able

to avoid noise, motion, and vibration disturbance by temporarily relocating to suitable habitat near the worksite. Therefore, heavy equipment operation is expected to result in insignificant effects to listed fish species.

2. Chemical Contamination from Equipment Fluids

No refueling will occur near the stream, spill containment protocol and materials will be available, and machinery will be checked for leaks, which will address and minimize pollution risk from equipment operation. Therefore, water quality degradation from toxic chemicals associated with the project is discountable and insignificant.

3. Reduced Benthic Macroinvertebrate Community

Benthic (*i.e.*, bottom dwelling) aquatic macroinvertebrates may be temporarily lost or their abundance reduced when stream habitat is excavated. Effects to aquatic macroinvertebrates resulting from excavation activities will be temporary because instream activities will occur only during the low flow season, and rapid recolonization (about one to two months) of disturbed areas by macroinvertebrates is expected following disturbance (Cushman 1985, Thomas 1985, Harvey 1986). The adverse effects to salmonids are negligible because the area of disturbance represents a very small portion of the creek's benthic habitat, and recolonization of the excavated area is anticipated shortly after project completion. Therefore, the loss of aquatic macroinvertebrates resulting from excavation activities is not expected to adversely affect coho salmon or steelhead.

4. Increased Mobilization of Sediment within the Stream Channel

The proposed project involves ground disturbance within the stream channel. Inherent with ground disturbance is the potential to increase background suspended sediment loads for a short period following project completion.

Although measures to minimize turbidity will be in place, short-term increases in turbidity are anticipated to occur during excavation activities. Research with salmonids has shown that high turbidity concentrations can reduce feeding efficiency, decrease food availability, reduce dissolved oxygen in the water column, result in reduced respiratory functions, reduce tolerance to diseases, and can also cause fish mortality (Berg and Northcote 1985, Gregory and Northcote 1993, Velagic 1995, Waters 1995). Mortality of very young coho salmon and steelhead fry can result from increased turbidity (Sigler *et al.* 1984). Even small pulses of turbid water will cause salmonids to disperse from established territories (Waters 1995), which can displace fish into less suitable habitat and increase competition and predation, decreasing chances of survival. Nevertheless, much of the research mentioned above focused on turbidity levels significantly higher than those likely to result from the proposed project activities, especially with implementation of the proposed avoidance and minimization measures. Stream flow is expected to be very low to non-existent during project implementation, so mobilized sediment will be easily contained by the proposed silt-fencing. Increased turbidity resulting from the proposed project will likely occur following the first rain event of the season, but the increase is expected to be of limited duration and at a level that does not result in physical effects to juvenile coho salmon or steelhead. The increased turbidity downstream of the project may induce a short-term behavioral response, but this response is not expected to result in reduced growth or permanent displacement from established territories.

## D. Adverse Effects to Listed Species

This section identifies the anticipated adverse effects of the proposed action on SONCC coho salmon, NC steelhead, and designated critical habitat for SONCC coho salmon, NC steelhead, and CC Chinook salmon.

Instream work associated with the project will occur over two days during the summer low flow period (June 1 to October 15), which will minimize the number of juvenile coho salmon and steelhead exposed to the project. The potential adverse effects to listed coho salmon and steelhead primarily result from fish relocation. Fish capture and relocation will likely result in injury and mortality to individual juvenile coho salmon and steelhead.

### 1. Fish Relocation Activities

Qualified fishery biologists will capture and relocate fish away from the project work site to eliminate adverse effects of instream excavation activities to listed salmonids. Fish in the immediate project area will first be herded downstream of the isolated work area. Then, any remaining fish will be captured by seine, dip net, or electrofishing, and then transported and released to a suitable instream location.

#### *a. Exposure:*

The species and life stages most likely to be exposed to fish relocation are juvenile coho salmon and steelhead. No adult salmonids or salmonid eggs are expected to be affected by fish relocation activities.

#### *b. Response:*

Any fish collecting gear, whether passive or active (Hayes 1983) has some associated risk to fish, including stress, disease transmission, injury, or death. The amount of unintentional injury and mortality attributable to fish capture varies widely depending on the method used, the ambient conditions, and the expertise and experience of the field crew. The effects of seining and dipnetting on juvenile salmonids include stress, scale loss, physical damage, suffocation, and desiccation. Electrofishing can kill juvenile salmonids, and researchers have found serious sublethal effects including spinal injuries (Reynolds 1983, Habera *et al.* 1996, Nielsen 1998, Habera *et al.* 1999, Nordwall 1999). The long-term effects of electrofishing on salmonids are not well understood. Although chronic effects may occur, most impacts from electrofishing are acute.

Most of the injury and mortality from fish relocation results from differences in water temperature between the stream and the temporary holding containers, dissolved oxygen conditions, the amount of time that fish are held out of the water, and physical injury. Handling-related stress increases rapidly if water temperature exceeds 18 °C or dissolved oxygen is below saturation. Since fish relocation activities will be conducted by designated qualified fisheries biologists following both CDFG and NMFS electrofishing guidelines, direct effects to, and mortality of, juvenile coho salmon, steelhead, or both during capture will be minimized.

Although sites selected for relocating fish will likely have similar water temperature as the capture site and should have ample habitat, in some instances relocated fish may endure short-term stress from crowding at the relocation sites. Relocated fish may also have to compete with

other salmonids, which can increase competition for available resources such as food and habitat. Some of the fish at the relocation sites may choose not to remain in these areas and may move either upstream or downstream to areas that have more habitat and lower fish densities. As each fish moves, competition remains either localized to a small area or quickly diminishes as fish disperse.

Fish relocation activities are expected to affect a small number of rearing juvenile coho salmon and/or steelhead within a 100-foot stream reach at and near the project site and relocation release site(s). Rearing juvenile coho salmon and/or steelhead present in the immediate project work area will be subject to disturbance, capture, relocation, and related short-term effects. Most of the take associated with fish relocation activities is anticipated to be in the form of non-lethal capture; however, a low number of rearing juvenile (mostly YOY) coho salmon and steelhead captured may be injured or die. In addition, the number of fish affected by increased competition is not expected to be significant at the fish relocation sites, based upon the suspected low number of relocated fish inhabiting the small project areas.

NMFS (2012) presented death and injury rates from dewatering and fish relocation activities gathered from a large number of restoration projects carried out in California. NMFS (2012) found it is reasonable to assume that no more than 0.7 percent and 0.6 percent of captured steelhead and coho salmon, respectively, will be injured and no more than 0.6 percent of captured steelhead and coho salmon will be killed during fish relocation. There are no estimates available of the number or density of juvenile coho salmon in the 100 feet of the channel containing steelhead and coho salmon that would be electrofished. However, based on recent CDFG survey data in Chadd Creek, NMFS believes it is reasonable to assume no more than 50 coho salmon juveniles and 50 steelhead juveniles may be relocated each year. Therefore, NMFS assumes no more than four juvenile steelhead (50 fish x 10 years x 0.007) and three juvenile coho salmon (50 fish x 10 years x 0.006) would be injured, and three juvenile steelhead (50 fish x 10 years x 0.006) and three coho salmon (50 fish x 10 years x 0.006) would be killed during the life of the permit.

Effects associated with fish relocation activities will be significantly minimized due to the multiple minimization measures that will be utilized. NMFS expects that fish relocation activities associated with implementation the project will not reduce the number of returning listed salmonid adults in Chadd Creek. Fish relocation activities will occur during the summer low-flow period after emigrating smolts have left the project site. Therefore, the majority of listed salmonids that will be captured during relocation activities will be age-0 coho and juvenile steelhead parr of various ages. Although most unintentional mortalities of coho salmon and steelhead during fish relocation activities will occur almost exclusively at the YOY stage, there is a potential for unintentional mortality of a one- or two-year-old steelhead.

### E. Effects to Critical Habitat

The project is expected to result in increased turbidity within the 100-foot excavation area within the wetted channel. However, measures will be taken to downstream areas minimize the potential of effects to downstream habitat. Isolation of the work area is expected to cause temporary loss, alteration, and reduction of aquatic habitat. The extent of temporary loss of juvenile rearing habitat should be minimal because habitat at the site is typically unsuitable

during summer low flow conditions. Salmonid food via drift is expected to be decreased in the reach downstream of the project site due to silt fencing spanning the wetted channel. In addition, a small amount of sediment may be mobilized after full-flowing water is returned to the excavation area. The project will occur during the summer months when water quality conditions are poor and salmonid populations are sparse. Although temporally and spatially limited, the project will likely result in temporary adverse effects to critical habitat.

### F. Effects of Interrelated and Interdependent Actions

Effects of the Proposed Action are analyzed together with the effects of other activities that are interrelated to, or interdependent with, that action. These include actions that are part of the proposed action and depend on the proposed action for their justification (interrelated actions) as well as actions that have no independent utility apart from the Proposed Action (interdependent actions, 50 CFR § 402.02). NMFS does not anticipate any interdependent or interrelated actions associated with the proposed action.

## VIII. CUMULATIVE EFFECTS

NMFS must consider both the "effects of the action" and the cumulative effects of other activities in determining whether the action is likely to jeopardize the continued existence of the SONCC coho salmon ESU, CC Chinook ESU, and the NC steelhead DPS considered in this opinion. Under the ESA, cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area. Listed salmonid species may be affected by numerous future non-federal activities, including timber harvest, road construction, residential development, agriculture, etc., which are described in the *Environmental Baseline* section. NMFS assumes these activities, and similar resultant effects, on listed salmonids species will continue during this project. NMFS did not identify any such activities in the action area.

## IX. INTEGRATION AND SYNTHESIS

The preceding analyses focused on both the likely direct and indirect effects from the County's project on listed salmonids and their habitat in the action area. This section considers the effects to individual salmonids and determines how effects to individuals would affect the VSP parameters of their constituent populations. The effects to individuals as described below incorporates the environmental baseline, effects of interrelated and interdependent actions, and cumulative effects, as described in those sections. Then, NMFS analyzes whether the effects to the populations would jeopardize the continued existence of the ESUs/DPS. In addition, this section assesses the effects of the proposed action on critical habitat to determine whether the effects rise to the level that the action results in the destruction or adverse modification of critical habitat for SONCC coho salmon, NC steelhead, or CC Chinook salmon.

### A. Effects on NC Steelhead

1. <u>Population Size</u>

The majority of fish present will be herded from the excavation site, and the remaining fish will be captured by electrofishing. No more than three juvenile steelhead are expected to be killed

and no more than four are expected to be injured over the 10-year-life of the project (see *Fish Relocation Activities* effects discussion above). Therefore, NMFS expects a small reduction in the juvenile steelhead population, but this reduction is not expected to result in a reduction in the abundance of adult steelhead in the population.

2. Population Productivity

The productivity of the Chadd Creek population is not expected to be affected because adult steelhead numbers are not expected to be reduced.

3. Spatial Structure

The spatial structure of the Chadd Creek steelhead population is not expected to be change.

4. Diversity

The diversity of affected steelhead populations is not expected to change by the loss of a small number of juvenile steelhead.

5. Summary

NMFS has determined the above effects are not likely to appreciably reduce the numbers, distribution or reproduction of NC steelhead. This is based on the small geographic extent of the proposed action, limited temporal extent of the proposed action, and the few juvenile steelhead that can be expected to be killed as a result of the proposed action.

**B. Effects on SONCC Coho Salmon**

1. Population Size

The majority of fish present will be herded from the excavation site, and the remaining fish will be captured by electrofishing. No more than three juvenile coho salmon are expected to be killed and no more than three are expected to be injured over the 10-year-life of the project (see *Fish Relocation Activities* effects discussion above). Therefore, NMFS expects a small reduction in the juvenile coho salmon population, but this reduction is not expected to result in a reduction in the abundance of adult coho salmon in the population.

2. Population Productivity

The productivity of the Chadd Creek population is not expected to be affected because adult coho salmon numbers are not expected to be reduced.

3. Spatial Structure

The spatial structure of the Chadd Creek coho salmon population is not expected to change.

4. Diversity

The diversity of the Chadd Creek coho salmon population is not expected to change by the loss of a small number of juvenile coho salmon.

5. Summary

NMFS has determined the above effects are not likely to appreciably reduce the numbers, distribution or reproduction of SONCC coho salmon. This is based on the small geographic

extent of the proposed action, limited temporal extent of the proposed action, and the few juvenile coho salmon that can be expected to be killed as a result of the proposed action.

### C. Effects on Critical Habitat

As discussed previously, only temporary adverse effects to critical habitat are expected. Therefore, the conservation value of the SONCC coho salmon, NC steelhead, or CC Chinook salmon critical habitat will not be reduced, and should increase as flooding and sediment deposition is reduced in the action area.

## X. CONCLUSION

After considering the best available scientific and commercial information, the current status of NC Steelhead, CC Chinook salmon, and SONCC coho salmon, and their designated critical habitats, the environmental baseline for the action area, the effects of the County's proposed project, and the cumulative effects, it is NMFS' biological opinion that the Corps issuance of an individual CWA section 404 permit to the County of Humboldt for the flow capacity improvement activities, as proposed, is not likely to jeopardize the continued existence of NC steelhead or SONCC coho salmon, and may affect, but is not likely to adversely affect CC Chinook salmon. NMFS also concludes that the action, as proposed, is not likely to result in the destruction or adverse modification of NC steelhead, CC Chinook salmon, or SONCC coho salmon critical habitats.

## XI. INCIDENTAL TAKE STATEMENT

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

The measures described below are nondiscretionary, and must be undertaken by the Corps so that they become binding conditions of any grant or permit issued to the County for the section 7(o)(2) exemption in to apply. The Corps has a continuing duty to regulate the activity covered by this incidental take statement. If the Corps (1) fails to assume and implement the terms and conditions or (2) fails to require the County to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, the Corps or the County must report the progress of the action and its impact on the species to NMFS as specified in the incidental take statement (50 CFR §402.14(i)(3)).

## A. Amount or Extent of Take

NMFS expects the proposed project will result in incidental take of listed SONCC coho salmon and NC steelhead during the project. Juvenile coho salmon and steelhead will be harassed, injure, or killed during fish relocating activities at the project site. NMFS expects no more than 50 juvenile coho salmon and 50 juvenile steelhead will be captured each year, and only a small number will be injured (0.6 percent for coho salmon, 0.7 percent for steelhead) or killed (0.6 percent for both species ). Therefore, NMFS expects no more than three juvenile SONCC coho salmon and four juvenile steelhead will be injured, and no more than three juvenile coho salmon and three steelhead will be killed over the duration of the 10 year proposed action.

## B. Effect of the Take

In the accompanying opinion, NMFS determined that this level of anticipated take is not likely to result in jeopardy to SONCC coho salmon or NC steelhead.

## C. Reasonable and Prudent Measures

NMFS believes the following reasonable and prudent measures are necessary and appropriate to minimize take of SONCC coho salmon and NC steelhead:

1. Measures shall be taken to minimize injury and mortality to juvenile coho salmon and steelhead resulting from fish relocation or instream construction activities.
2. Measures shall be taken to ensure that the Corps and/or County monitor and report take of listed salmonids.

## D. Terms and Conditions

In order to be exempt from the prohibitions of section 9 of the ESA, the Corps and the Applicant (County) must comply with the following terms and conditions, which implement the reasonable and prudent measures described above and outline required reporting/monitoring requirements. These terms and conditions are nondiscretionary.

1. The following terms and conditions implement Reasonable and Prudent Measure 1, which states that measures shall be taken to minimize harm and mortality to coho salmon, and steelhead resulting from fish relocation or instream construction activities:

    a. Fish relocation data must be provided as described in Term and Condition 2 below. If injury or mortality of captured coho salmon or steelhead exceeds the amount described above, activities must immediately cease so that the cause of excessive injury or mortality can be assessed and ameliorated. NMFS shall be contacted at the address below within 24 hours. Fish killed shall be placed immediately in alcohol or placed on ice and delivered to the NMFS office identified under Term and Condition 2 below.

2. The following terms and conditions implement Reasonable and Prudent Measure 2, which states that measures shall be taken to ensure that the project will minimize take of listed salmonids, monitor and report take of listed salmonids, and to obtain specific project information to better account for the effects and benefits the project.

a. In order to monitor the impact to, and to track incidental take of coho salmon and steelhead, the Corps and/or the County must submit to NMFS an annual project completion report. The report shall be submitted by February 1 of each year in which project implementation occurs, and shall include the following:

- A description of the location from which fish were removed and the release site, including: photographs, the date and time of the relocation effort, a description of the equipment and methods used to collect, hold, and transport listed salmonids, whether an electroshocker was used for fish collection, a copy of the logbook, the number of fish relocated by species, the number and species of fish injured or killed, a brief narrative of the circumstances surrounding listed salmonid injuries or mortalities, and a description of any problems which arose during the relocation activities and a statement as to whether or not the activities had any unforeseen effects.

Each annual report shall be submitted to NMFS at:

National Marine Fisheries Service
Northern California Office Supervisor
1655 Heindon Road
Arcata, California 95521

## XII. REINITIATION NOTICE

This concludes formal consultation on the Chadd Creek Flow Capacity Improvement Project. As per 50 CFR § 402.16, reinitiation of formal consultation is required and shall be requested by the Federal agency or by NMFS, where discretionary Federal involvement or control over the action has been retained or is authorized by law, and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the action that may affect listed species in a manner or to an extent not previously considered, (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

## XIII. CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the ESA directs Federal agencies to utilize their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. NMFS provides the following conservation recommendation:

- The County is encouraged to analyze the conveyance conditions of the action area before and after sediment excavation in order to determine the effectiveness of the project. If the removal of sediment is not shown to alleviate flooding, alternative solutions should be developed and proposed for subsequent years. In order to prevent ongoing maintenance activities, NMFS also supports the development of a long-term plan that evaluates and addresses improved conveyance capacity for the road crossing.

In order for NMFS to be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats, NMFS requests notification of the implementation of any conservation recommendations.

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**Enclosure 2**

# MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT CONSULTATION

## I. INTRODUCTION

The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267, 16 U.S.C. § 1801 *et seq*.), established new requirements for Essential Fish Habitat (EFH) descriptions in Federal fishery management plans and require Federal agencies to consult with the NOAA's National Marine Fisheries Service (NMFS) on activities that may adversely affect EFH. EFH for Pacific Coast salmon was described in Appendix A, Amendment 14 to the Pacific Coast Salmon Fishery Management Plan (Pacific Fishery Management Council 2000). The U.S. Army Corps of Engineers' (Corps) permitting of the Chadd Creek Flow Capacity Improvement Project affects Chadd Creek, which has been designated EFH for Pacific salmon.

Only species managed under a Federal fishery management plan are covered under the MSFCMA. Coho salmon and Chinook salmon are managed under Federal fishery management plans. Thus, these EFH conservation recommendations address coho salmon and Chinook salmon.

## II. LIFE HISTORY AND HABITAT REQUIREMENTS

General life history information and Evolutionarily Significant Unit (ESU) status for Southern Oregon/Northern California Coast (SONCC) coho salmon and California Coastal (CC) Chinook are discussed in the associated biological opinion. Further detailed information on coho salmon ESUs is available in the NOAA Fisheries status review for coho salmon from Washington, Oregon, and California (Weitkamp *et al.* 1995). Detailed information on Chinook salmon ESUs available in the NOAA Fisheries status review for Chinook salmon from Washington, Idaho, Oregon, and California (Myers *et al.* 1998).

## III. PROPOSED ACTION

The Corps proposes to permit, under section 404 of the Clean Water Act, the County of Humboldt's removal of sediment from Chadd Creek to improve flow capacity and prevent flooding at the concrete box culvert located beneath Holmes Flat Road in Humboldt County, California. Project activities would occur once annually, as necessary, for the proposed 10-year permit period (2012 through 2021). A detailed description is provided in the associated biological opinion.

## IV. EFFECTS OF THE PROPOSED ACTION

Effects of the proposed action on coho salmon and Chinook salmon EFH are those associated with short-term increased sedimentation, killing of salmonid prey species, and chemical contamination from heavy equipment. These effects are described in the associated biological opinion.

## V. CONCLUSION

After reviewing the effects of the project, NOAA Fisheries has determined that the proposed action would adversely affect coho salmon and Chinook salmon EFH.

## VI. EFH CONSERVATION RECOMMENDATIONS

The proposed action contains adequate measures to avoid, minimize, mitigate, or otherwise offset the adverse effects to EFH. Therefore, NMFS has no additional Conservation Recommendations.

## VII. FEDERAL AGENCY STATUTORY REQUIREMENTS

The MSFCMA [section 305(b)(4)(B)] and Federal regulations [50 CFR § 600.920(j)] to implement the EFH provisions of the MSFCMA require Federal action agencies to provide a written response to EFH conservation recommendations within 30 days of their receipt. A preliminary response is acceptable if a final response cannot be completed within 30 days. The final response must include a description of measures proposed to avoid, mitigate, or offset the adverse effects of the activity on EFH. If your response is inconsistent with our EFH conservation recommendations, the Corps must provide an explanation for not implementing those recommendations.

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