UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404-4731

December 18, 2020 **Refer to NMFS No:** WCRO-2020-02052

Darrell Cardiff
Senior Environmental Planner
California Department of Transportation (District 1)
P.O. Box 3700
Eureka, California 95502

Re: Endangered Species Act Section 7(a)(2) Biological Opinion and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Hill Road Bridge Replacement Project

Dear Mr. Cardiff:

Thank you for your letter of July 27, 2020, requesting initiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the Hill Road Bridge replacement project. This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016). Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855(b)) for this action.

The enclosed biological opinion is based on our review of the California Department of Transportation's (Caltrans) proposed project and describes NMFS' analysis of potential effects on threatened California Coastal (CC) Chinook salmon (*Oncorhynchus tshawytscha*), Northern California (NC) steelhead (*Oncorhynchus mykiss*) and designated critical habitat for these species in accordance with section 7 of the ESA. In addition, we include the potential affects to critical habitat for Southern Oregon and Northern California Coasts (SONCC) coho salmon (*Oncorhynchus kisutch*) and omit inclusion of effects to species of SONCC coho salmon because they have not been present in the Middle Fork Eel for decades. In the enclosed biological opinion, NMFS concludes the project is not likely to jeopardize the continued existence of these species; nor is it likely to adversely modify critical habitat. However, NMFS anticipates that take of CC Chinook salmon and NC steelhead may occur. An incidental take statement which applies to this project with non-discretionary terms and conditions is included with the enclosed opinion.

NMFS has reviewed the proposed project for potential effects on EFH and determined that the proposed project would adversely affect EFH for Pacific Coast Salmon, which are managed under the Pacific Coast Salmon Fishery Management Plan. While the proposed action will result in adverse effects to EFH, the proposed project contains measures to minimize, mitigate, or otherwise offset the adverse effects; thus, no EFH Conservation Recommendations are included in this opinion.

Please contact Thomas Daugherty, North Central Coast Office in Santa Rosa, California at (707) 468-4057, or via email at Tom.Daugherty@noaa.gov if you have any questions concerning this section 7 and EFH consultation, or if you require additional information.

Sincerely,

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

Enclosure

cc: Christa Unger, Caltrans Eureka CA, Christa.Unger@dot.ca.gov
Copy to E-File: ARN 151422WCR2020SR00160

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion [and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response]

Hill Road Bridge

NMFS Consultation Number: WCRO-2020-02052
Action Agency: California Department of Transportation

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species?	Is Action Likely To Jeopardize the Species?	Is Action Likely to Adversely Affect Critical Habitat?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Northern California steelhead (*Oncorhynchus mykiss*)	Threatened	Yes	No	Yes	No
California Coastal Chinook (*O. tshawytscha*)	Threatened	Yes	No	Yes	No
Southern Oregon Northern California Coasts coho salmon *(O. kisutch)*	Threatened	No	No	Yes	No

Fishery Management Plan That Identifies EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast Salmon	Yes	No

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By:

Alecia Van Atta
Assistant Regional Administrator
California Coastal Office

Date: December 18, 2020

TABLE OF CONTENTS

1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3, below.

1.1. Background

NOAA's National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), and implementing regulations at 50 CFR 402, as amended.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600.

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the Santa Rosa California office.

1.2. Consultation History

The Biological Assessment (BA) (Caltrans 2020) states that this Project which is a local assistance project proposed by the County of Mendocino (County) has been in development since 2008. An updated species list of anadromous fish was obtained from NMFS on January 19, 2018 and updated on November 13, 2019. On July 28, 2020 NMFS received an initiation package from the California Department of Transportation (Caltrans) requesting formal consultation for the proposed project which included the BA and cover letter. NMFS reviewed the BA for sufficiency and accepted the initiation package on August 12, 2020 for formal interagency consultation. During the development of this opinion, the County via an email dated 11-24-2020 (email from C. Collins, County of Mendocino to Thomas Daugherty, NMFS) further described the proposed dewatering and fish relocation area of the proposed project.

1.3. Proposed Federal Action

Under the ESA, "action" means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02). Federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910). Under MSA, Federal action means any action authorized, funded, or undertaken, or proposed to be authorized, funded, or undertaken by a Federal Agency (50 CFR 600.910).] We considered, under the ESA, whether or not the proposed action would cause any other activities and determined that it would not cause additional effects beyond those that are from the action as described below.

The project is being proposed and implemented at the discretion of the County with Caltrans approval under authority of the Federal Highway Administration. The proposed project includes Hill Road Bridge that spans Mill Creek and portions of Hill Road situated southeast of Covelo, California in northeastern unincorporated Mendocino County.

The proposed project would replace an existing single-lane bridge with a new two-lane bridge and widen the existing roadway approaches. The new bridge would be approximately 145 feet (ft.) long and 26 ft. wide, which would be 25 ft. longer and 8 ft. wider than the existing bridge. The horizontal alignment of the new bridge would match that of the existing bridge, which is approximately perpendicular to the normal stream alignment of Mill Creek. The new bridge would be similar in character to the existing bridge, namely a single-span, steel truss structure. In addition to the new bridge, approximately 200 ft. sections of the roadway on either side of the bridge would be improved with two 9 ft. wide travel lanes and 2 ft. wide shoulders to accommodate the new bridge deck elevation, width, and location. The new bridge will be located in the same footprint as the existing bridge; therefore, the approaches will remain in the same place, reducing total impact to the site.

Construction, including road widening and tree trimming, is anticipated to take place from March to November 2024. The existing bridge crossing will be closed to vehicles and detours will route traffic around the crossing while the existing bridge is dismantled and the new bridge is constructed. Traffic would be routed around the Project site utilizing alternate roadways in the area. No temporary crossing is proposed. Temporary staging would occur within the roadway on either side of Mill Creek and would be used for delivery and storage of construction materials, for fueling and maintenance of equipment, and for contractor parking.

Vegetation removal is needed to build a temporary road down to the creek bed for construction activities. Approximately 0.1 acre of valley oak woodland habitat will be affected by widening Hill Road on either side of the bridge and installation of the new abutments. This area is limited to a narrow strip along the alignment and may require removing understory vegetation and trimming of overhanging branches to accommodate the increased width. Construction would require removal of alder, willow, and oaks as well as understory shrubs and various grasses. The majority of the trees to be removed have tree trunk diameters less than four inches diameter at breast height (dbh).

Construction activities within the banks of Mill Creek will be performed between June 15 and October 15, when there is little or no stream flow. If water is present in the channel between June and October, the flow will be diverted by either placing sandbags, installing two sets of k-rails and a rubber lining, installing super sacks, or installing sheetpiles along the construction area to allow flow to continue through the construction area. Depending on the amount of flow present the contractor shall implement one of the above-listed diversion methods. If flow is shallow, sand bags can be placed along the construction area. If there is a greater amount of flow present either the k-rail, super sack, or sheetpile option could be implemented. If there is no flow during the construction period which is typical at this site, diversion may be unnecessary.

If flow is present and dewatering is required the County proposes to dewater 240 ft. of Mill Creek (C. Collins, County of Mendocino, email November 24, 2020). Relocation and dewatering activities would begin with block nets placed at each end of the area and qualified biologists would capture and relocate any native fish or other native aquatic species present in the reach to be dewatered. Once dewatering is implemented and flow is diverted away from the construction area, a biologist would be present and any standing water would be observed for fish. All fish located within the construction area immediately prior to or during dewatering will be captured by seine, dip net, and/or electrofisher and removed by qualified biologists pre-approved by NMFS. The fish will be placed in an aerated cooler or 5-gallon bucket of water from the habitat they were captured in and then be relocated within 30 minutes of capture to suitable habitat within the action area, but outside the immediate project footprint. Fish relocation will occur prior to the start of the June 15 work window and is only anticipated to occur for one construction season. A relocation plan would be prepared and submitted to NMFS for approval at least two weeks prior to the start of construction.

Upon completion of dewatering and fish relocation, construction equipment, including cranes, excavators, jack hammers, and shovels, will be used to remove the existing bridge deck, truss, concrete abutments, headwalls, and associated footings from the creek. Existing concrete abutments located outside of the creek channel will be cut below grade and left in place. Demolition waste will be stockpiled and sorted beyond the banks of the creek.

New abutments will be placed behind the existing abutments and further up the bank from the creek channel. This would effectively widen the opening at the bridge by approximately 10 ft. on the east bank and 20 ft. on the west bank. The foundation for the new abutments will be steel pipe piles that will require pile driving for installation. The piles will be installed from the new approaches and outside the low-flow channel through silty gravels under the eastern abutment and through silty gravels, silty sand, and clay under the western abutment. The eastern abutment will be constructed on two rows of eleven piles placed at 4 foot intervals. The western abutment will be constructed on two rows one comprised of 16 piles and the other 17 piles. The two rows will be 4 ft. apart and the piles in each row spaced at 4-foot intervals. The steel pipe piles are estimated to be approximately 30 ft. in length, and 16 inches in diameter. Piles at each new bridge support will be placed below the scour line of the streambed of Mill Creek to a maximum depth of 30 ft. All pile driving will be limited to channel banks (no pile driving will occur in the wetted portion area of Mill Creek).

A temporary access road would be constructed along the gravel bar along the western side of the wetted portion of the channel to accommodate limited as-needed construction activities, such as the installation of scour protection for the abutments. Rock slope protection (RSP) along the eastern bank would be placed from top of bank prior to installation of the bridge. A crane will be used to set the new prefabricated steel structure in place.

Creek banks will be re-contoured to match the existing bank slopes, or to a maximum 2:1 slope, where existing abutments are removed. After obtaining the engineered grade of the channel banks, RSP would be placed to armor and protect the banks from potential erosion. There would be permanent placement of approximately 2,600 square ft. (90 linear ft.) of RSP on the east bank and approximately 3,100 square ft. (95 linear ft.) on the west bank. Once the new bridge and RSP is complete, the construction area, including any exposed and disturbed areas of the creek bank, will be seeded and mulched. Native plants including locally sourced willow cuttings will be used for re-vegetation. The total construction disturbance area for the bridge replacement project is estimated to be less than one acre (0.9 acre).

1.3.1 Avoidance and Minimization Measures

The project has been designed to avoid and minimize impacts to Mill Creek and the surrounding habitat by proposing to build the replacement bridge in the same footprint as the existing bridge and by not placing any permanent bridge structures in the creek channel. The proposed avoidance and minimization measures (AMMs) focus on minimizing the potential for sediment delivery, toxic material to the stream reach and protecting habitat features of the active channel bed and banks. Measures to avoid direct effects within the creek by limiting the construction timeframe to summer and early fall when the stream is typically dry and avoiding any permanent modification of the active stream channel. If wetted habitat and salmonids are present the work area will be dewatered and aquatic species would be relocated as described above.

A Stormwater Pollution Prevention Plan (SWPPP) and Spill Prevention Control and Countermeasures Plan (SPPC) will be implemented to maintain water quality within Mill Creek. These plans include measures such as isolating on-site earthen stockpiles with a silt fence, filter fabric, and/or straw bales/fiber rolls. Silt fence and/or fiber rolls will also be placed at bridge abutments, new abutment excavation areas, and any other locations when work could result in loose sediment possibly entering the creek. The silt fence/fiber rolls would be maintained and kept in place for the duration of the project. Any sediment or debris captured by the fence/rolls will be removed before the fence/rolls are removed. Additional erosion, sediment, and material stockpile best management practices (BMPs) would be employed, as necessary, between work areas and the adjacent waterway to avoid the potential for sediment latent runoff to enter the stream.

2. Endangered Species Act: Biological Opinion And Incidental Take Statement

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

2.1. Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion relies on the definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02).

The designation of critical habitat for species uses the term primary constituent element (PCE) or essential features. The 2016 critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The 2019 regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the regulations (84 FR 44977), that definition does not change the scope of our analysis and in this opinion we use the terms "effects" and "consequences" interchangeably.

We use the following approach to determine whether a proposed action is likely to jeopardize listed species or destroy or adversely modify critical habitat:

- Evaluate the rangewide status of the species and critical habitat expected to be adversely affected by the proposed action.

- Evaluate the environmental baseline of the species and critical habitat.
- Evaluate the effects of the proposed action on species and their habitat using an exposure-response approach.
- Evaluate cumulative effects.
- In the integration and synthesis, add the effects of the action and cumulative effects to the environmental baseline, and, in light of the status of the species and critical habitat, analyze whether the proposed action is likely to: (1) directly or indirectly reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species, or (2) directly or indirectly result in an alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species.
- If necessary, suggest a reasonable and prudent alternative to the proposed action.

2.2. Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the function of the PBFs that are essential for the conservation of the species.

2.2.1. Species Description and Life History

The biological opinion analyses the effects of the federal action on the following Federally-listed species (Distinct Population Segment (DPS) or Evolutionary Significant Unit (ESU)) and designated critical habitat:

Threatened Northern California (NC) steelhead DPS (*Oncorhynchus mykiss*)
Threatened (71 FR 834, January 5, 2006)
Critical habitat (70 FR 52488, September 2, 2005);

Threatened California Coastal (CC) Chinook salmon ESU (*O. tshawytscha*)
Threatened (70 FR 37160; June 28, 2005)
Critical habitat designation (70 FR 52488; September 2, 2005);

Threatened Southern Oregon Northern California Coasts (SONCC) coho salmon ESU (*O. kisutch*) Critical habitat designation (64 FR 24049; May 5, 1999).

Critical habitat is designated for SONCC coho salmon in all accessible reaches throughout the ESU, however, SONCC coho salmon are not currently known to inhabit the Mill Creek watershed area of the Middle Fork Eel River. Caltrans determined the proposed action is not likely to adversely affect threatened SONCC coho salmon. Therefore, this biological opinion does not further analyze effects to individual SONCC coho salmon as there are no expected effects to this species.

2.2.2. General Life History of Listed Species

2.2.2.1. Steelhead

Steelhead are the anadromous form of *O. mykiss*, spawning in freshwater and migrating to marine environments to grow and mature. Steelhead have a complex life history that requires successful transition between life stages across a range of freshwater and marine habitats (*i.e.,* egg-to-fry emergence, juvenile rearing, smolt outmigration, ocean survival, and upstream migration and spawning). Steelhead exhibit a high degree of life history plasticity (Shapovalov and Taft 1954; Thrower et al. 2004; Satterthwaite et al. 2009). The occurrence and timing of these transitions are highly variable and generally driven by environmental conditions and resource availability (Satterthwaite et al. 2009; Sogard et al. 2012).

Steelhead are generally divided into two ecotypes based on timing and state of maturity when returning to freshwater: summer-run and winter-run. Summer-run steelhead return to natal streams in spring and early summer while they are still sexually immature and spend several months maturing before spawning in January and February (Nielson and Fountain 2006). Winter-run steelhead enter natal streams as mature adults with well-developed gonads. They typically immigrate between December and April and spawn shortly after reaching spawning grounds (Shapovalov and Taft 1954; Moyle et al. 2008).

Adult steelhead spawn in gravel substrates with low sedimentation and suitable flow velocities. Females lay eggs in redds, where they are quickly fertilized by males and covered. Egg survival depends on oxygenated water circulating through the gravel, facilitating gas exchange and waste removal. Adults usually select spawning sites in pool-riffle transition areas of streams with gravel cobble substrates between 0.6 to 10.2 centimeters (cm) in diameter and flow velocities between 40 - 91cm per second (Smith 1973; Bjornn and Reiser 1991). Eggs incubate in redds for approximately 25 to 35 days depending on water temperature (Shapovalov and Taft 1954). Incubation time depends on water temperature, with warmer temperatures leading to lower incubation periods due to increased metabolic rates. Eggs hatch as alevin and remain buried in redds for an additional two to three weeks until yolk-sac absorption is complete (Shapovalov and Taft 1954). Optimal conditions for embryonic development include water temperatures between 6 and 10°C, dissolved oxygen near saturation, and fine sediments less than 5% of substrate by volume (Bjornn and Reiser 1991; USEPA 2001).

Upon emerging from redds, juvenile steelhead occupy edgewater habitats where flow velocity is lower and cover aids in predator avoidance. Rearing juveniles feed on a variety of aquatic and terrestrial invertebrates. As they grow, juveniles move into deeper pool and riffle habitats where they continue to feed on invertebrates and have been observed feeding on younger juveniles (Chapman and Bjornn 1969; Everest and Chapman 1972). Juveniles can spend up to four years rearing in freshwater before migrating to the ocean as smolts, although they typically only spend one to two years in natal streams (Shapovalov and Taft 1954; Busby et al. 1996). Successful rearing depends on stream temperatures, flow velocities, and habitat availability. Preferred water temperature ranges from 12 to 19°C and sustained temperatures above 25°C are generally considered lethal (Smith and Li 1983; Busby et al. 1996). In Central California streams, juvenile steelhead are able to survive peak daily stream temperatures above 25°C for short periods when food is abundant (Smith and Li 1983). Response to stream temperatures can vary depending on the conditions to which individuals are acclimated, however, consistent exposure to high stream temperatures results in slower growth due to elevated metabolic rates and lower survival rates overall (Hokanson et al. 1977; Busby et al. 1996).

Juveniles undergo behavioral, morphological, and physiological changes in preparation for ocean entry, collectively called smoltification. Juveniles begin smoltification in freshwater and the process continues throughout downstream migration with some smolts using estuaries for further acclimation to saltwater prior to ocean entry (Reiser and Bjornn 1979). Juveniles typically will not smolt until reaching a minimum size of 160 mm (Burgner et al. 1992). Smoltification is cued by increasing photoperiod. Stream temperatures influence the rate of smoltification, with warmer temperatures leading to more rapid transition. Downstream migration of smolts typically occurs from April to June when temperature and stream flows increase. Preferred temperature for smoltification and outmigration is between 10 and 17°C with temperatures below 15°C considered optimal (Hokanson et al. 1977; Wurtsbaugh and Davis 1977; Zedonis and Newcomb 1997; Myrick and Cech 2005). In coastal systems with seasonal lagoons, smolts may take advantage of higher growth potential in productive lagoon habitats before ocean entry (Osterback et al. 2018).

Adult steelhead are known to be highly migratory during ocean residency but little is known of their habitat use and movements. They have been observed moving north and south along the continental shelf, presumably to areas of high productivity to feed (Barnhart 1986). Adults will typically spend one to two years in the ocean, feeding and growing in preparation for spawning (Shapovalov and Taft 1954; Busby et al. 1996). Upstream migration typically begins once winter rains commence and stream flows increase. For coastal systems with seasonal freshwater lagoons, winter storms are required to breech the sandbars and allow access to upstream spawning sites. Unlike most congeneric species, steelhead are iteroparous, meaning they can return to spawn multiple times. Adult steelhead may spawn up to four times in their lifetime, although spawning runs predominantly consist of first-time spawners (~59%) (Shapovalov and Taft 1954). The maximum life span of steelhead is estimated to be nine years (Moyle 2002).

2.2.2.2. Chinook Salmon

Chinook salmon follow the typical cycle of Pacific salmon, hatching in freshwater, migrating to the ocean, and returning to freshwater to spawn and die. Diversity within this life cycle exists, however, in the time spent at each stage. Chinook salmon are classified into two groups, ocean-type and stream-type, based on the period of freshwater residence (Healey 1991; Meyers et al. 1998). Fall or late fall-run fish enter freshwater at an advanced stage of maturity, move rapidly to their spawning areas on the mainstem or lower tributaries of rivers, and spawn within a few weeks of freshwater entry. Juveniles emigrate to estuarine or marine environments shortly after emergence from the red (Healey 1991). Stream-type fish are typically winter or spring-run fish that have a protracted adult freshwater residency, sometimes spawning several months after entering freshwater. Progeny of stream-type fish frequently spend one or more years in freshwater before emigrating. After emigrating, Chinook salmon remain in the ocean for two to five years and tend to stay in the coastal waters off California and Oregon (Healey 1991). Chinook salmon are also characterized by the timing of adult returns to freshwater for spawning, with the most common types referred to as fall-run and spring-run fish.

Chinook generally remain in the ocean for two to five years (Myers et al. 1998). Some Chinook salmon return from the ocean to spawn one or more years early. These early maturing fish are referred to as jacks (males) and jills (females). The low flows, high water temperatures, and sand bars that develop in smaller coastal rivers of coastal California during the summer months favor an ocean-type life history or fall-run (Myers *et al*. 1998). With this life history, adults enter freshwater between August and January (Fukushima and Lesh 1998; Chase *et al.* 2007) and smolts typically outmigrate as sub-yearlings between April and July (Myers *et al*. 1998). Fall-run fish typically enter freshwater with fully developed gonads, move rapidly to their spawning areas on the mainstem or lower tributaries of mainstem rivers (elevations of 200 to 1,000 feet), and spawn within a few weeks of freshwater entry. In contrast, spring-run fish inhabit large river systems with high elevation tributaries fed by melting snowpack. Spring-run fish enter river systems during peak snowmelt, between April and August, with undeveloped gonads that mature over the summer. These fish migrate when high flows facilitate passage into cold, headwater tributaries where the fish hold until they spawn later that fall.

Spawning generally occurs in swift, relatively shallow riffles or along the edges of fast runs at depths greater than 24 cm. Adult female Chinook salmon prepare redds in stream areas with suitable gravel composition, water depth, and velocity. Individual females spawn for five to fourteen days and will guard or defend their redds for two to four weeks before dying (Beauchamp *et al.* 1983). The number of eggs a female produces generally ranges from 2,000–17,000 (Groot and Margolis 1991) and is not directly correlated to fish size (Hassler 1987; Moyle 2002). Optimal spawning temperatures range between 5.6 and 13.9°C. Redds vary widely in size and location within the river. Preferred spawning substrate is clean, loose gravel, mostly sized between 1.3 and 10.2 cm, with fine sediment not exceeding 10 percent. Chinook salmon eggs incubate for 90 to 150 days depending on water temperature (Allen and Hassler 1986). Successful incubation depends on several factors, including dissolved oxygen levels, temperature, substrate size, amount of fine sediment, and water velocity. Maximum survival of incubating eggs and pre-emergent fry occurs at water temperatures between 5.6 and 13.3°C with an optimal temperature of 11.1°C. Alevins remain in the gravel for a month or longer (about four to six weeks) until they emerge as fry (Beauchamp *et al.* 1983; Moyle 2002). Fry emergence begins in December and continues into mid-April (Leidy and Leidy 1984).

After emergence, Chinook salmon fry seek out areas behind fallen trees, back eddies, undercut banks, and other cover (Everest and Chapman 1972). Cover, in the form of rocks, submerged aquatic vegetation, logs, riparian vegetation, and undercut banks provides food, shade, and protects juveniles from predation. As they grow larger, juveniles move away from stream margins and begin to use deeper water areas with slightly faster water velocities, but continue to use available cover to minimize the risk of predation and reduce energy expenditure (Chapman and Bjornn 1969; Everest and Chapman 1972).

2.2.2 Status of Listed Species

NMFS assesses four population viability[1] parameters to discern the status of the listed ESUs and DPSs and to assess each species ability to survive and recover. These population viability parameters are abundance, population growth rate, spatial structure, and diversity (McElhany et al. 2000). While there is insufficient data to evaluate these population viability parameters quantitatively, NMFS has used existing information to determine the general condition of the populations in the NC steelhead DPS, the CC Chinook salmon ESU, and the factors responsible for the current status of these listed species.

The population viability parameters are used as surrogates for numbers, reproduction, and distribution, as defined in the regulatory definition of jeopardy (50 CFR 402.20). For example, abundance, population growth rate, and distribution are surrogates for numbers, reproduction, and distribution, respectively. The fourth parameter, diversity, is related to all three regulatory criteria. Numbers, reproduction, and distribution are all affected when genetic or life history variability is lost or constrained, resulting in reduced population resilience to environmental variation at local or landscape-level scales.

2.2.2.3. CC Chinook Salmon

The CC Chinook salmon ESU was historically comprised of approximately 32 Chinook salmon populations (Bjorkstedt et al. 2005). Many of these populations (14) were independent, or potentially independent, meaning they have a high likelihood of surviving for 100 years absent anthropogenic impacts. The remaining populations were likely more dependent upon immigration from nearby independent populations than dependent populations of other salmonids (Bjorkstedt et al. 2005).

Data on CC Chinook abundance, both historical and current, is sparse and of varying quality (Bjorkstedt et al. 2005). Estimates of absolute abundance are not available for populations in this ESU (Myers et al. 1998). In 1965, CDFG (1965) estimated escapement for this ESU at over 76,000. Most were in the Eel River (55,500), with smaller populations in Redwood Creek (5,000), Mad River (5,000), Mattole River (5,000), Russian River (500) and several smaller streams in Humboldt County (Myers et al. 1998). More recent information from Sonoma Water monitoring at their Mirabel fish ladder from 2000 to 2014 suggests moderate to good abundance

[1] NMFS defines a viable salmonid population as "an independent population of any Pacific salmonid (genus *Oncorhynchus*) that has a negligible risk of extinction due to threats from demographic variation, local environmental variation, and genetic diversity changes over a 100- year time frame" (McElhany et al. 2000).

of Russian River Chinook salmon with 1,113 to 6,696 adult fish reported (Martini and Manning 2015).

CC Chinook salmon populations remain widely distributed throughout much of the ESU. Notable exceptions include the area between the Navarro River and Russian River and the area between the Mattole and Ten Mile River populations (Lost Coast area). The lack of Chinook salmon populations both north and south of the Russian River (the Russian River is at the southern end of the species' range) makes it one of the most isolated populations in the ESU. Myers et al. (1998) reports no viable populations of Chinook salmon south of San Francisco, California.

Because of their prized status in the sport and commercial fishing industries, CC Chinook salmon have been the subject of many artificial production efforts, including out-of-basin and out-of-ESU stock transfers (Bjorkstedt et al. 2005). It is, therefore, likely that CC Chinook salmon genetic diversity has been adversely affected despite the relatively wide population distribution within the ESU. An apparent loss of the spring-run Chinook life history in the Eel River Basin and elsewhere in the ESU also indicates risks to the diversity of the ESU.

Data from the 2009 adult CC Chinook salmon return counts and estimates indicated a further decline in returning adults across the range of CC Chinook salmon on the coast of California (Jeffrey Jahn, NMFS, personal communication 2010). Ocean conditions are suspected as the principal short-term cause because of the wide geographic range of declines (SWFSC 2008). However, the number of adult CC Chinook salmon returns in the Russian River Watershed increased substantially in 2010/2011 compared to 2008/09 and 2009/10 returns. Increases in adult Chinook salmon returns during 2010/2011 have been observed in the Central Valley populations as well.

The most recent status review summary by Seghesio and Wilson (2016) reports that the new information available since the last status review (Williams et al. 2011) does not appear to suggest there has been a change in extinction risk for this ESU. Williams et al. (2011) found that the loss of representation from one diversity stratum, the loss of the spring-run history type in two diversity substrata, and the diminished connectivity between populations in the northern and southern half of the ESU pose a concern regarding viability for this ESU. Based on consideration of this updated information, Williams et al. (2011) concluded the extinction risk of the CC Chinook salmon ESU has not changed since the last status review which affirmed no change to the determination that the CC Chinook salmon ESU is a threatened species, as previously listed (NMFS 2011, 76 FR 50447). NMFS' previous status review (Williams et al. 2011) discussed the fact that populations that lie between the lower boundary of the Central Valley Fall Chinook salmon ESU (Carquinez Straits) and the southern boundary of CC Chinook salmon ESU (Russian River) were not included in either ESU, despite the fact that Chinook salmon had been reported in several basins. Available genetic evidence indicated fish from the Guadalupe and Napa rivers in San Francisco and San Pablo Bays had close affinity with Central Valley Fall Chinook salmon (Garza and Pearse 2008), and it was recommended that fish from these two watersheds be included in the Central Valley Fall Chinook ESU. Evidence for fish in Lagunitas Creek was equivocal, with 17 samples assigned almost equally between CC Chinook salmon and Central Valley Fall Chinook salmon. The biological review team in 2011 from

SWFSC tentatively concluded that Lagunitas Creek Chinook salmon should be considered part of the CC Chinook salmon ESU pending additional data (Williams et al. 2011). NMFS subsequently indicated that a boundary change was under consideration (76 FR 50447); however, no action has been taken to date. Currently there is no new genetic information that helps resolve this issue (Spence 2016). This most recent status review of this CC Chinook salmon suggest that spatial gaps between extant populations along the Mendocino coast are not as extensive as previously believed (Seghesio and Wilson 2016). As stated above, this information has not changed the determination that the extinction risk for this ESU remains as threatened (Seghesio and Wilson 2016).

The NMFS's recovery plan (NMFS 2015) for the CC Chinook salmon ESU identified the major threats to recovery. These major threats include channel modification, roads, logging and timber harvesting; water diversions and impoundments; and severe weather. The impacts of these major threats are described in the effects to critical habitat section. New threats to Chinook salmon populations identified since the last status review include poor ocean conditions, drought, and marijuana cultivation (Seghesio and Wilson 2016).

2.2.2.4. NC Steelhead

Historically, the NC steelhead DPS was comprised of 41 independent populations (19 functionally and 22 potentially independent) of winter run steelhead and 10 functionally independent populations of summer run steelhead (Bjorkstedt et al. 2005). Based on the limited data available (dam counts of portions of stocks in several rivers), NMFS' initial status review of NC steelhead (Busby et al. 1996) determined that population abundance was very low relative to historical estimates (1930s and 1960s dam counts), and recent trends were downward in most stocks. Overall, population numbers are severely reduced from pre-1960s levels, when approximately 198,000 adult steelhead migrated upstream to spawn in the major rivers supporting this Distinct Population Segment (DPS) (Busby et al. 1996, 65 FR 36074).

NMFS status reviews reached the same conclusion, and noted the poor amount of data available, especially for winter run steelhead (NMFS 1997, Good et al. 2005). The information available suggested that the population growth rate was adverse. It is known that dams on the Mad River and Eel River block large amounts of habitat historically used by NC steelhead (Busby et al. 1996). Hatchery practices in this DPS have exposed the wild population to genetic introgression and the potential for deleterious interactions between native stock and introduced steelhead. Historical hatchery practices at the Mad River hatchery are of particular concern, and included out-planting of non-native Mad River hatchery fish to other streams in the DPS and the production of non-native summer steelhead (65 FR 36074). The conclusion of an earlier status review by (Good et al. 2005) echoes that of previous reviews. Abundance and productivity in this DPS are of most concern, relative to NC steelhead spatial structure (distribution on the landscape) and diversity (level of genetic introgression).

NMFS evaluated the listing status of NC steelhead and proposed maintaining the threatened listing determination (71 FR 834) in 2006. A subsequent status review by Williams et al. (2011) reported a mixture of patterns in population trend information, with more populations showing declines than increases. Although little information was available to assess the status for most population in the NC steelhead DPS, overall Williams et al. (2011) found little evidence to suggest a change in status compared to the last status review by Good et al. (2005).

The most recent status review (Seghesio and Wilson 2016) found that information on steelhead populations in the NC steelhead DPS has improved considerably in the past 5 years, due to implementation of the CMP across a significant portion of the DPS. Nevertheless, significant gaps in information still remain, particularly in the Lower Interior and North Mountain Interior diversity strata, where there is very little information from which to assess status. Overall, the available data for winter-run populations— predominately in the North Coastal, North-Central Coastal, and Central Coastal strata— indicate that all populations are well below viability targets, most being between 5% and 13% of these goals. For the two Mendocino Coast populations with the longest time series, Pudding Creek and Noyo River, the 13-year trends have been adverse and neutral, respectively (Spence 2016). However, the short-term (6-year) trend has been generally beneficial for all independent populations in the North-Central Coastal and Central Coastal strata, including the Noyo River and Pudding Creek (Spence 2016). Data from Van Arsdale Station likewise suggests that, although the long-term trend has been adverse, run sizes of natural-origin steelhead have stabilized or are increasing (Spence 2016). Thus, we have no strong evidence to indicate conditions for winter-run populations in the DPS have worsened appreciably since the status review by Williams et al. (2011).

Most populations for which there are population estimates available remain well below viability targets; however, the short-term increases observed for many populations, despite the occurrence of a prolonged drought in northern California, suggests this DPS is not at immediate risk of extinction (Seghesio and Wilson 2016).

2.2.2.5. CC Chinook Salmon, SONCC Coho Salmon and NC Steelhead Critical Habitat

In designating critical habitat, NMFS considers, among other things, the following requirements of the species: 1) space for individual and population growth, and for normal behavior; 2) food, water, air, light, minerals, or other nutritional or physiological requirements; 3) cover or shelter; 4) sites for breeding, reproduction, or rearing offspring; and, generally; and 5) habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of this species (50 CFR 424.12(b)). In addition to these factors, NMFS also focuses on physical and biological features, or PBFs, and/or essential habitat types within the designated area that are essential to conserving the species and that may require special management considerations or protection.

PBFs for CC Chinook salmon SONCC coho salmon and NC steelhead critical habitat, and their associated essential features within freshwater include:

1. freshwater spawning sites with water quantity and quality conditions and substrate supporting spawning, incubation and larval development;
2. freshwater rearing sites with:
    a. water quantity and floodplain connectivity to form and maintain physical habitat conditions and support juvenile growth and mobility;

b. water quality and forage supporting juvenile development; and
c. natural cover such as shade, submerged and overhanging large wood, log jams and beaver dams, aquatic vegetation, large rocks and boulders, side channels, and undercut banks;

3. freshwater migration corridors free of obstruction and excessive predation with water quantity and quality conditions and natural cover such as submerged and overhanging large wood, aquatic vegetation, large rocks and boulders, side channels, and undercut banks supporting juvenile and adult mobility and survival.

Generally for CC Chinook salmon, and SONCC, NC steelhead) critical habitat the following essential habitat types were identified: 1) juvenile summer and winter rearing areas; 2) juvenile migration corridors; 3) areas for growth and development to adulthood; 4) adult migration corridors; and 5) spawning areas. Within these areas, essential features of 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 24029).

The condition of CC Chinook salmon, SONCC coho salmon, and 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 currently depressed population conditions are, in part, the result of the following human-induced factors affecting critical habitat: logging, agriculture, mining, urbanization, stream channelization, dams, wetland loss, and water withdrawals (including unscreened diversions for irrigation). Impacts of concern include altered stream bank and channel morphology, elevated water temperature, lost spawning and rearing habitat, habitat fragmentation, impaired gravel and wood recruitment from upstream sources, degraded water quality, lost riparian vegetation, and increased erosion into streams from upland areas (Weitkamp et al. 1995; Busby et al. 1996; 64 FR 24049; 70 FR 37160; 70 FR 52488). Diversion and storage of river and stream flow has dramatically altered the natural hydrologic cycle in many of the streams within the ESU. Altered flow regimes can delay or preclude migration, dewater aquatic habitat, and strand fish in disconnected pools, while unscreened diversions can entrain juvenile fish.

2.2.3. Additional Threats to CC Chinook salmon, SONCC Coho Salmon, NC Steelhead and their Critical Habitat

Global climate change presents an additional potential threat to salmonids and their critical habitats. Impacts from global climate change are already occurring in California. For example, average annual air temperatures, heat extremes, and sea level have all increased in California over the last century (Kadir et al. 2013). Snow melt from the Sierra Nevada Mountains has declined (Kadir et al. 2013). However, total annual precipitation amounts have shown no discernable change (Kadir et al. 2013). Listed salmonids may have already experienced some detrimental impacts from climate change. NMFS believes the impacts on listed salmonids to date are likely fairly minor because natural, and local, climate factors likely still drive most of the climatic conditions steelhead experience, and many of these factors have much less influence on steelhead abundance and distribution than human disturbance across the landscape.

The threat to listed salmonids from global climate change will increase in the future. Modeling of climate change impacts in California suggests that average summer air temperatures are expected to continue to increase (Lindley et al. 2007; Moser et al. 2012). Heat waves are expected to occur more often, and heat wave temperatures are likely to be higher (Hayhoe et al. 2004, Moser et al. 2012; Kadir et al. 2013). Total precipitation in California may decline; critically dry years may increase (Lindley et al. 2007; Schneider 2007; Moser et al. 2012). Wildfires are expected to increase in frequency and magnitude (Westerling et al. 2011, Moser et al. 2012).

For Northern California, most models project heavier and warmer precipitation. Extreme wet and dry periods are projected, increasing the risk of both flooding and droughts (OEHHA 2018). Estimates show that snowmelt contribution to runoff in the Sacramento/San Joaquin Delta may decrease by about 20 percent per decade over the next century (Cloern et al. 2011). Many of these changes are likely to further degrade listed salmonid habitat by, for example, reducing stream flows during the summer and raising summer water temperatures. Estuaries may also experience changes detrimental to salmonids. Estuarine productivity is likely to change based on changes in freshwater flows, nutrient cycling, and sediment amounts (Scavia et al. 2002, Ruggiero et al. 2010). In marine environments, ecosystems and habitats important to juvenile and adult salmonids are likely to experience changes in temperatures, circulation, water chemistry, and food supplies (Brewer and Barry 2008; Feely 2004; Osgood 2008; Turley 2008; Abdul-Aziz et al. 2011; Doney et al. 2012). The projections described above are for the mid to late 21st Century. In shorter time frames, climate conditions not caused by the human addition of carbon dioxide to the atmosphere are more likely to predominate (Cox and Stephenson 2007; Santer et al. 2011).

2.3. Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02).

The total construction disturbance area is estimated to be just under an acre (0.9 acre). This area includes the expansion on the roadway approaches, areas along the creek where the new abutments will be placed, and the slightly widened bridge footprint. Placement of RSP to protect bridge abutments will effect approximately 2,600 square ft. (90 linear ft.) along the eastern bank and approximately 3,100 square ft. (95 linear ft.) on the western bank of Mill Creek. Proposed dewatering and fish relocation will extend approximately 120 feet upstream and downstream (total of 240 ft.) from the bridge replacement site to provide equipment access for pile driving and other bridge construction actions.

2.4. Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. 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 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

2.4.1 Status of Listed Species and Critical Habitat in the Action Area

Hill Road Bridge lies in the southeast corner of Round Valley and crosses Mill Creek approximately two miles from the mouth of the Middle Fork Eel River. In the early 1900s, Round Valley streams were extensively modified which resulted in significant stream incision throughout the valley that disconnected the streams from their floodplains (NMFS 2014). Mill Creek is a third order stream and has approximately 13.7 miles of blue line stream and drains a watershed of approximately 105 square miles. Summer base flow is approximately 0.3 cubic feet per second (cfs) and over 5,700 cfs for a 100-year winter storm event (Rau Associates Inc. 2013). The watershed is privately owned and has lands that are part of the Round Valley Indian Tribe reservation and is managed for timber production, rangeland, has scattered rural residences and the small town of Covelo.

Although Mill Creek is currently in poor condition from anthropogenic impacts since the late 1800's, the action area currently provides spawning and rearing habitat for NC steelhead and CC Chinook salmon (NMFS 2016). Very little data is available on the current status of Chinook salmon and steelhead in Mill Creek. A Survey of upper Mill Creek conducted by the DFW (CDFG 1996) in a 500 square foot area found 7 young-of-the-year steelhead, one stickleback (*Gasterosteus aculeatus*), and 50 California roach (*Lavinia symmetricus*). Chinook salmon are known to spawn and rear in Mill Creek in most years until juvenile fish move out of the area during the spring (W. Mitchell, personal communication 2020).

The action area, represents a small fraction (.25 miles) of the 294 miles of potential steelhead habitat for the Middle Fork Eel River steelhead population and 324 miles of Chinook salmon habitat in the Upper Eel River Chinook population. The current conditions in the project area are generally poor during the summer months with little to no surface flow and minimal riparian canopy to maintain stream temperature. This reach does provide spawning and rearing habitat for steelhead and salmon in the winter and spring, with limited steelhead rearing during the summer months due to low flow or dry conditions. Although the action area has had 150 years of anthropogenic impacts, it is an important spawning reach where Chinook and steelhead adults can find spawning habitat during the winter flow events in the Middle Fork Eel River. Summer rearing habitat is not expected to recover in this area in the foreseeable future due to groundwater diversions and other rural water use that has developed since the arrival of European man. The

Multi-Species Recovery Plan (NMFS 2016) identifies actions to reduce stream diversions through off channel storage for grazing, cannabis production and rural residential development. NMFS (2016), also calls for LWD and riparian shade improvements to increase salmonid rearing habitat quality.

Given that streamflow and temperatures for salmonids the action area is currently stressed during the hot summer months, we also rely on information from section 2.2.4 with respect to the broader climatic variables influencing the current condition of habitat in the action area. Variables such as air temperature, wind patterns, and precipitation are likely influencing localized environmental conditions, such as water temperature, stream flow, and food availability. These local environmental conditions can affect the biology of listed species and the functioning of critical habitat and its value for conservation. The combination of climate change effects and effects of past and current human activities on local environmental conditions further reduce the current condition of habitat in Mill Creek.

2.4.2 Previous Section 7 Consultations in the Action Area

Upper Mill Creek area has had extensive stream restoration over the past two-decades. This reach is approximately 5-miles from the action area and is a low gradient reach where the channel changes from higher gradient to the low gradient valley floor. The Round Valley Indian Tribe with grants from NOAA Fisheries and Natural Resource Conservation Services (NRCS) placed rock slope protection, willow baffles and planted riparian vegetation to restore a highly aggraded reach of stream. Section 7 interagency consultation was conducted with NOAA Fisheries for the stream restoration actions funded by NRCS. With respect to the specific proposed project, there are no known previous Section 7 consultations or Section 10 permits have occurred within the action area.

2.5. Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered 50 CFR 402.17(a) and (b).

Construction activities, both during and post-project completion, associated with the proposed project may affect NC steelhead and CC Chinook salmon and their designated critical habitat, as well as critical habitat designated for SONCC. The following may result from construction activities: unintentional direct injury or mortality during fish collection, relocations, and dewatering activities; temporary loss of benthic habitat; reductions in riparian vegetation and cover, and temporary impacts to channel bed morphology.

2.5.1. Vegetation Removal and Staging

Minor vegetation and removal will be conducted to make room for staging materials and equipment. Tree removal and vegetation trimming could cause impacts to shade and reduction to potential wood recruitment to the stream channel. The project will result in temporary reductions in riparian vegetation during tree removal for construction access and staging, and for construction of the new bridge. Riparian vegetation helps maintain stream habitat conditions necessary for salmonid growth, survival, and reproduction. Riparian vegetation disturbance and removal can degrade these ecosystem functions and impair stream habitat. Removal of riparian vegetation increases stream exposure to solar radiation, leading to increases in stream temperature (Poole and Berman 2001).

A total of 21 trees will be removed to accommodate the larger footings and bank protection required. Ten trees are larger than 12 inches at diameter breast height (dbh) and 11 trees less than 12 inches dbh. Loss of the larger riparian trees is expected to result in minor changes in shade that may result in some increase solar radiation to the wetted channel. Minor impacts from riparian removal will likely to be mitigated within 2 to 5 years with the proposed revegetation of the project area. The removal of a few larger trees is expected to reduce the potential for LWD recruitment, which may reduce habitat quality in the action area. Overall reduction in habitat quality is expected to be minor with loss of one or two trees that may recruited to the channel periodically that may reduce cover and pool development. This minor reduction in habitat quality may cause individual fish to seek alternative areas where suitable areas exists nearby, such that the reduction in tree recruitment is not expected to reduce or limit the survival of individual salmon or steelhead utilizing the action area. AMMs applied during implementation, and site restoration are expected to substantially reduce the impact of riparian vegetation removal on salmonids and their habitat. The project site will also be monitored for five years following construction to ensure the success of revegetation efforts to restore areas impacted from removal of riparian revegetation. Thus, impacts of reduced shade and cover from removal of riparian vegetation are not expected to significantly change rearing and migratory behavior of individual salmonids within the action area.

The proposed project will expand the roadway approaches, areas along the creek where the new abutments will be placed, and the slightly widened bridge footprint. A Stormwater Pollution Prevention Plan (SWPPP) and Spill Prevention Control and Countermeasures Plan (SPPC) will be implemented to maintain water quality within Mill Creek. Implementation of these plans is expected to reduce or avoid sediment and toxic materials from transporting into Mill Creek. With the proposed plans to protect water quality, the areas that are proposed for staging and construction, including in channel areas are not expected to result in runoff or toxic spills that will adversely affect ESA listed salmonids or critical habitat.

2.5.2. Dewatering and Fish Relocation

To facilitate the completion of the project, a portion of the Mill Creek may need to be dewatered. As discussed above, depending on the water-year and rainfall patterns the action area may have surface flow on June 15 when instream construction is proposed to begin. The project proposes to collect and relocate fish in the work area prior to, and during, dewatering to avoid fish stranding and exposure to construction activities. Before and during dewatering of the construction site, juvenile salmonids will be captured by a qualitied biologist using one or more of the following methods: dip net, seine, thrown net, block net, minnow trap, and electrofishing. Collected salmonids will be relocated to an appropriate stream reach that will minimize impacts to captured fish, and to fish that are already residing at the release site. Since construction is scheduled to occur between June 15 and October 1, relocation activities will occur during the summer low-flow period after emigrating smolts have left and before adults have immigrated for spawning. Only juvenile salmonids are expected to be in the action area during this construction period. Therefore, NMFS expects capture and relocation of listed salmonid species will be limited to pre-smolting and young-of-the-year juveniles.

Fish collection and relocation activities pose a risk of injury or mortality to rearing juvenile salmonids. Any fish collecting gear, whether passive (Hubert 1996) 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. Since fish relocation activities will be conducted by qualified fisheries biologists following NMFS electrofishing guidelines (NMFS 2000), injury and mortality of juvenile salmonids during capture and relocation will be minimized. Based on prior experience with current relocation techniques and protocols likely to be used to conduct the fish relocation, unintentional mortality of listed juvenile salmonids expected from capture and handling procedures is not likely to exceed 3 percent.

Relocated fish may also have to compete with other fish causing increased competition for available resources such as food and habitat. Responses to crowding by salmonids include self-thinning, resulting in emigration and reduced salmonid abundance with increased individual body size within the group, and/or increased competition (Keeley 2003). Some of the fish released at the relocation sites may choose not to remain in these areas and move either upstream or downstream to areas that have more vacant habitat and a lower density of fish. As each fish moves, competition remains either localized to a small area or quickly diminishes as fish disperse. In some instances, relocated fish may endure some short-term stress from crowding at the relocation sites. Such stress is not likely to be sufficient to reduce their individual fitness or performance. Although sites selected for relocation fish will be pre-approved by NMFS, they should have similar water temperatures as the capture sites, and should have adequate habitat to allow for survival of transported fish and fish already present. NMFS cannot accurately estimate the number of fish likely to be affected by competition, but does not expect this short-term stress to reduce the individual performance of juvenile salmonids, or cascade through watershed population of these species based on the area that will likely be affected and the relatively small number of salmonids likely to be relocated.

Despite the fact that most juvenile Chinook salmon migrate out of the action area during the spring, there is some potential for this species to be present during the dewatering and relocation.

Therefore, NMFS assumes a small number of juvenile Chinook may be encountered and relocated during dewatering activities.

Applying applicable AMMs to fish collection, relocation, and dewatering activities is expected to appreciably reduce the effects of project actions on juvenile salmonids. Specifically, fish collection and relocation activities conducted by NMFS-approved fisheries biologists will ensure proper equipment operation and application of NMFS guidelines thereby minimizing injury and mortality to juvenile salmonids. Restricting the work window to June 15 through October 1 will limit the effects to stream rearing juvenile salmonids. NMFS expects applying AMMs will effectively minimize injury and mortality to juvenile steelhead and Chinook salmon in the action area.

2.5.3. Effects of Underwater Sound Exposure

The dual metric criteria for injury to fish from pile driving was established by the Fisheries Hydroacoustic Working Group (FHWG 2008) and includes a threshold for peak pressure (206 dB) and cSEL (187 dB for fishes 2 grams or larger and 183 dB for fishes smaller than 2 grams). Injury would be expected if either threshold is exceeded. There is uncertainty as to the behavioral response of fish to underwater sound produced when driving piles in or near water, NMFS believes a 150 dB root mean square pressure (RMS) threshold for behavioral responses for salmonids is appropriate.

This project includes two abutments that will support the bridge. Pile driving will be required for the west abutment, the piles for the east abutment will be cast-in-drilled-hole (CIDH) piles and pile driving will not be required. The noise from the drilling for the CIDH piles would not be measurable in the water according to hydro acoustic analysis conducted by Illingworth and Rodkin (Caltrans 2020). However, the impact pile driving for the 16-inch steel piles on the west bank would cause levels of 150 dB RMS to reach areas of about 115 feet from the pile driving to wetted portions of Mill Creek. The County has proposed a dewatering area of 120 ft. upstream and downstream to avoid levels of 150 dB RMS, which otherwise could cause disturbance or behavioral effects to juvenile salmonids. The removal of juvenile fish from the potential zone of pile driving effects above 150dB RMS is expected to avoid any adverse effects within the project area.

2.5.4. Bank Revetment and Project Closure

A temporary access road would be constructed along the gravel bar along the western side of the wetted portion of the channel to accommodate limited as-needed construction activities, such as the installation of scour protection for the abutments. RSP along the eastern abutment would be 90 feet long and the west abutment would be similar with 95 feet of permanent RSP.

By design, streambank stabilization projects prevent lateral channel migration, effectively forcing streams into a simplified linear configuration that, without the ability to move laterally, instead erode and deepen vertically (Leopold et al. 1968; Dunn and Leopold 1978). The resulting "incised" channel fails to create and maintain aquatic and riparian habitat through lateral migration, and can instead impair groundwater/stream flow connectivity and repress floodplain and riparian habitat function. The resulting simplified stream reach typically produces limited macroinvertebrate prey and poor functional habitat for rearing juvenile salmonids (Florsheim et al. 2008).

The proposed RSP for this project is expected to cause simplification of habitat around the bridge abutments in the future. This bridge replacement does provide a longer span and thus the abutments encroach less on the stream channel as compared to existing bridge. Placing the bridge abutments and RSP further back into the banks is expected to allow the stream channel to transport sediment and develop a natural pool and riffle sequence. The areas where the RSP is placed will continue to impede channel migration and riparian development along approximately 100 feet on both sides of Mill Creek. The change in habitat function is not expected to change significantly from the conditions that existed with the previous bridge in place. Upon completion of instream work and cofferdam removal, instream habitat may be decreased due to equipment disturbance and redistribution of gravel within the construction area. Disturbance from using heavy equipment in the streambed is expected to be minimized with winter high flow events that will redistribute gravels and restore channel form.

Upon completion of instream work and bridge construction, AMMs will be implemented to reduce runoff of sediment and to revegetate the site. As described above in Section 2.5.2 above, implementation of Stormwater Pollution Prevention Plan (SWPPP) and Spill Prevention Control and Countermeasures Plan (SPPC) are expected to maintain water quality within Mill Creek during the project and at the conclusion of project activities. These AMMs, such as silt fence and/or fiber rolls that will be placed at bridge abutments, new abutment excavation areas, and any other locations when work could result in loose sediment possibly entering the creek. The silt fence/fiber rolls would be maintained and kept in place for the duration of the project. Any sediment or debris captured by the fence/rolls will be removed before the fence/rolls are removed. Additional erosion, sediment, and material stockpile AMMSs would be implemented to disturbed areas in order to avoid runoff to the stream channel. With these measures in place, NMFS does expect that measureable or significant erosion from the construction site will occur.

Although the proposed project addresses the potential run-off from the construction of the new bridge, post construction storm water BMPs were not proposed as part of the project to address water quality concerns associated with road projects as detailed by numerous sources such as the California State Water Resources Control Board (CSWRCB). The CSWRCB has issued a storm water permit for Caltrans, which includes background information from a recent publication that identifies a degradation product of tires as the causal factor in salmonid mortalities at concentrations of less than a part per billion (Tian et al., 2020). This contaminant is widely used by multiple tire manufacturers and the tire shreds that produce it have been found to be ubiquitous where both rural and urban roadways drain into waterways (Sutton et al., 2019). Previous published work first focused on identifying the issue and determining the cause of observed mortalities of adult coho salmon in the wild (Scholz et al., 2011) and then showed mortality to juvenile coho salmon in laboratory settings (Chow et al., 2019). More recent examinations of juvenile steelhead and Chinook salmon by NMFS Northwest Fisheries Science Center and partners also indicates mortality of up to 40% for steelhead and up to 10% for Chinook (Tian et al., 2020). The presence of Chinook salmon and steelhead will likely coincide with the rainy season that may bring them into contact with contaminants from the bridge and roadway. Therefore, run-off from the bridge deck and the road approaches to the new bridge are likely to deliver tire shreds to stream channel and result in adverse effects to salmonids within the action area. Mortality is expected to be low due to the rural setting of the proposed project and may be minimized with proper road drainage at the site.

Also, the County will revegetate disturbed areas where construction and tree removal occurs, upon completion of project construction. Revegetation activities will include planting native species and specifically willow cuttings, that when established are expected to increase shade within the action area of Mill Creek and minimize losses of vegetation due to removal required for the project.

2.5.5. Critical Habitat Effects

The action area is designated critical habitat for CC Chinook, NC steelhead, and SONCC coho salmon. Generally speaking, PBFs of critical habitat for both steelhead and salmon found within the action area include sites for migration, spawning, and rearing (see section 2.4). Effects of the Project on designated critical habitat include temporary disturbance to the streambed, bank, and flow from dewatering; temporary disturbance to waterways from pile driving; temporary and permanent loss of riparian vegetation during construction access and staging; and temporary loss of habitat from proposed dewatering activities.

Regarding effects to critical habitat from project site dewatering, for the same reasons described above for juvenile salmonids, adverse effects to CC Chinook salmon, and NC steelhead and critical habitat PBFs are expected to be temporary, insignificant, and will recover relatively quickly (one to two months) after the project site is re-watered. Similarly, for reasons described above for juvenile salmonids, turbidity levels from suspended sediment are not expected to occur or effect the value of critical habitat in the action area. Based on the size of the area to be dewatered (240 linear feet) for the instream construction activities, their will a reduction in available wetted habitat over the proposed June 15 to October 15 construction window. CC Chinook, NC steelhead, and SONCC coho salmon critical habitat will be unavailable as a summer rearing habitat. The action area is dry during most years, and provides marginal habitat during the summer months for NC steelhead, therefore this temporary loss of wetted habitat is not expected to result in a significant impact to the available critical habitat ESA listed species.

Minor impacts to LWD recruitment and shade are expected to reduce habitat quality in the action area. Loss of LWD from removal of streambanks will reduce the potential for removed trees to recruit to the channel and provide habitat in the future. The loss of this LWD recruitment is not expected to significantly reduce cover or habitat forming roughness elements in Mill Creek. Revegetation proposed by the County is expected to provide similar shade to the action area within 2-5 years of project completion.

2.6. Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02 and 402.17(a)). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 2.4).

2.7. Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) Reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

CC Chinook salmon status remains as threatened (NMFS 2016) due to the continuing threats that face this species including poor ocean conditions, drought and reduced freshwater habitat quality. Throughout the ESU there has been a mix in the population trends, with some population abundance increasing and others decreasing (NMFS 2016). Overall, there is a lack of compelling evidence to suggest that the status of these populations has improved or deteriorated appreciably since the previous status review (Williams et al. 2011). The temporary and minor loss of Chinook salmon habitat along the Mill Creek is unlikely to reduce the overall abundance of the Chinook salmon population in the Upper Eel River. The reduction in habitat quality within the action area is expected to reduce spawning or rearing habitat quality in a relatively small area in Mill Creek. The proposed project is not expected to limit the number of Eel River Chinook salmon utilizing Mill Creek, given the current population abundance in the Eel River, and that few individual juvenile fish utilize Mill Creek during the summer work window.

Mill Creek is part of the Middle Fork Eel River "independent" population, and serves an essential role in the NC steelhead recovery effort (NMFS 2016). As with Chinook, a small number of steelhead inhabiting the action area may experience a reduced likelihood of survival prior to reaching the smolt lifestage and migrating to sea, primarily due to reduced fitness and growth brought on by project construction and loss of wetted habitat. However, the anticipated small loss of juvenile steelhead is unlikely to appreciably impact the future survival and recovery at the DPS scale since adequate quantities of habitat remain within the tributary reaches of the Middle Fork Eel River from which the lost production can be regained.

Global climate change presents another real threat to the long-term persistence of CC Chinook salmon and NC steelhead, especially when combined with the current depressed population status and human caused impacts. Regional (i.e., North America) climate projections for the mid to late 21st Century expect more variable and extreme inter-annual weather patterns, with a gradual warming pattern in general across California and the Pacific Northwest. However, extrapolating these general forecasts to our smaller action area is difficult, given local nuances in geography and other weather-influencing factors. Water temperatures may rise somewhat in the action area due to climate change over the next several decades, reinforcing the likelihood of reduced carrying capacity in the action area due to loss of riparian habitat as described above.

The proposed action will degrade PBFs and essential habitat types in the action area, namely those related to juvenile rearing. Yet, the effects of the proposed action, when added to the environmental baseline, cumulative effects, and species status, are not expected to appreciably reduce the quality and function of critical habitat at the larger CC Chinook and SONCC coho salmon ESUs or NC steelhead DPS, given the small area being degraded compared to the quality and quantity of habitat within the Middle Fork Eel River watershed. Thus, the proposed action will not impair the ability of critical habitat to play its intended conservation role of supporting populations of CC Chinook salmon, SONCC coho salmon, and NC steelhead at the ESU and DPS levels.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of NC steelhead and or destroy or adversely modify its designated critical habitat.

After reviewing and analyzing the current status of the listed species, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of CC Chinook or destroy or adversely modify its designated critical habitat.

After reviewing and analyzing the current status of the critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to destroy or adversely modify SONCC coho salmon designated critical habitat.

2.9. Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a 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 regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). “Incidental take” is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1. Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

Take of listed juvenile and CC Chinook salmon and NC steelhead may occur during fish relocation and dewatering in a 240 linear foot reach at the project site between June 15 and October 1. The number of NC steelhead that may be incidentally taken during dewatering activities is expected to be small, and limited to the pre-smolt and young-of-year juvenile life stage. NMFS expects that no more than 3 percent of juvenile steelhead within the 240 linear foot dewatering area of Mill Creek will be injured, harmed, or killed during fish relocation and dewatering activities. If more than 3 percent of the total number juvenile steelhead captured are harmed or killed, incidental take will have been exceeded.

Similarly, the number of CC Chinook salmon that may be incidentally taken during dewatering activities is expected to be low (as a result of migration since most juveniles will migrate to estuarine or marine environments by June 15 of each year), and will be limited to the pre-smolt/young-of-year juvenile life stage. NMFS expects that no more than 3 percent of the fish within the 240 linear foot dewatering area of the Mill will be injured, harmed, or killed during fish relocation and dewatering activities. If more than 3 percent of the total number of juvenile CC Chinook salmon captured are harmed or killed, incidental take will have been exceeded.

In addition, low numbers of CC Chinook and NC steelhead within the action area may be incidentally taken due to Stormwater run-off delivered to Mill Creek from the new bridge and the road approaches to the bridge. Mortalities associated with Stormwater runoff is unquantifiable, but are expected to be low due relatively low transportation use in the rural setting of the project.

2.9.2. Effect of the Take

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to the species or destruction or adverse modification of critical habitat.

2.9.3. Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

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

1. undertake measures to ensure that injury and mortality to salmonids resulting from fish relocation and dewatering activities is low;
2. undertake measures to minimize harm to salmonids from construction of the project and degradation of aquatic habitat;
3. Implement measures to reduce direct delivery of run-off from road approaches and the bridge deck to Mill Creek;
4. prepare and submit plans and reports regarding the effects of fish relocation, and post-construction revegetation performance.

2.9.4. Terms and Conditions

The terms and conditions described below are non-discretionary, and Caltrans or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). Caltrans or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. The following terms and conditions implement reasonable and prudent measure 1:

   a. The Caltrans/County shall retain a qualified biologist with expertise in the areas of anadromous salmonid biology, including handling, collecting, and relocating salmonids; salmonid/habitat relationships; and biological monitoring of salmonids. The applicant shall ensure that all fisheries biologists working on this project be qualified to conduct fish collections in a manner which minimizes all potential risks to ESA-listed salmonids. Electrofishing, if used, shall be performed by a qualified biologist and conducted according to the *NOAA Fisheries Guidelines for Electrofishing Waters Containing Salmonids Listed under the Endangered Species Act*, *June 2000.* See: http://www.nwr.noaa.gov/ESA-Salmon-Regulations-Permits/4d-Rules/upload/electro2000.pdf.

b. The fisheries biologist shall monitor the construction site during placement and removal of cofferdams, and channel diversions, to ensure that any adverse effects to salmonids are minimized. The biologist shall be on site during all dewatering events in anadromous fish streams to ensure that all ESA-listed salmonids are captured, handled, and relocated safely. During fish relocation activities the fisheries biologist shall contact NMFS North Coast Branch staff at (7070 575-6050, if mortality of federally listed salmonids exceeds 3 percent of the total for each species collected, at which time NMFS will stipulate measures to reduce the take of salmonids.

c. If ESA-listed fish are handled, it shall be with extreme care and they shall be kept in water to the maximum extent possible during rescue activities. All captured fish shall be kept in cool, shaded, aerated water protected from excessive noise, jostling, or overcrowding any time they are not in the stream and fish shall not be removed from this water except when released. To avoid predation the biologist shall have at least two containers and segregate young-of-year salmonids from larger age-classes and other potential aquatic predators. Captured salmonids will be relocated as soon as possible to a suitable instream location (pre-approved by NMFS) where suitable habitat conditions are present to allow for survival of transported fish and fish already present.

d. Non-native fish that are captured during fish relocation activities shall not be relocated to anadromous streams, or areas where they could access anadromous habitat.

2. The following terms and conditions implement reasonable and prudent measure 2:

a. Caltrans/County will allow any NMFS employee(s) or any other person(s) designated by NMFS to accompany field personnel to visit the project site during activities described in this opinion.

b. Any pumps used to divert live stream flow will be screened and maintained throughout the construction period to comply with NMFS' Fish Screening Criteria for Anadromous Salmonids (2000).

c. Construction equipment used within the river channel will be checked each day prior to work within the river channel (top of bank to top of bank) and, if necessary, action will be taken to prevent fluid leaks. If leaks occur during work in the channel, Caltrans or their contractors will contain the spill and removed the affected soils.

d. Once construction is completed, all project-introduced material must be removed, leaving the river as it was before construction. Excess materials will be disposed of at an appropriate disposal site. Minor grading to return the channel to pre-project form can be performed if necessary.

3. The following terms and conditions implement reasonable and prudent measure 3:

a. Caltrans/County must implement measures to minimize road generated run-off to Mill Creek by diverting road surface flow to vegetated areas between the road and the stream channel.

b. Measures should be implemented to reduce run-off from the bridge deck to Mill Creek.

c. Any structures such as relief ditches, grading to direct flow, other diversion structures must receive regular long term maintenance, with a focus on early fall to reduce run-off from the first rains that cause flush of materials from the summer months.

4. The following terms and conditions implement reasonable and prudent measure 4:

a. **Project Construction and Fish Relocation Report** – Caltrans must provide a written report to NMFS by January 15 of the year following construction (2023). The report must be submitted to NMFS' North-Central Coast Office, Attention: North Coast Branch Chief, 777 Sonoma Avenue, Room 325, Santa Rosa, California, 95404-6528. The report must contain, at minimum, the following information:

i. **Construction related activities** – The report(s) must include the dates construction began and was completed; a discussion of any unanticipated effects or unanticipated levels of effects on salmonids, including a description of any and all measures taken to minimize those unanticipated effects and a statement as to whether or not the unanticipated effects had any effect on ESA-listed fish; the number of salmonids killed or injured during the project action; and photographs taken before, during , and after the activity from photo reference points.

ii. **Fish relocation** – The report(s) must include a description of the location from which fish were removed and the release site(s) including photographs; the date and time of the relocation effort; a description of the equipment and methods used to collect, hold, and transport salmonids; if an electrofisher was used for fish collection, a copy of the logbook must be included; the number of fish relocated by species; the number of fish injured or killed by species and a brief narrative of the circumstances surrounding ESA-listed fish injuries or mortalities; and a description of any problems which may have arisen during the relocation activities and a statement as to whether or not the activities had any unforeseen effects.

b. **Post-Project Annual Monitoring Reports** – Annual Project reports will be sent to the address above in 3a, and must include the following contents:

iii. **Post-Construction Vegetation Monitoring and Reporting** – Caltrans must develop and submit for NMFS' review, a plan to assess the success of the revegetation of the site. A draft of the revegetation monitoring plan must be submitted to NMFS (address specified in 3a above) for review and approval three months prior to the beginning of project construction (i.e., must be submitted March 15, which is three months before the proposed June 15, 2022 start date). Reports documenting post-project conditions of vegetation installed at the site will be prepared and submitted annually for the first five years following project completion, unless the site is documented to be performing poorly, then monitoring requirements will be extended. Reports will document vegetation health and survivorship and percent cover, natural recruitment of native vegetation (if any), and any maintenance or replanting needs. Photographs must be included. If poor establishment is documented, the report must include recommendations to address the source of the performance problems.

2.10. Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

1. NMFS recommends that Caltrans and/or the County develop a LWD project in or near the action area to promote salmonid habitat quality in Mill Creek. This project would benefit recovery of critical habitat PBFs for juvenile and adult lifestages of CC Chinook salmon and NC steelhead. This project should encompass approximately 500 feet in length and provide 10 to 20 key pieces of LWD.

2.11. Reinitiation of Consultation

This concludes formal consultation for the Hill Road Bridge project. As 50 CFR 402.16 states, reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA , EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)]

This analysis is based, in part, on the EFH assessment provided by Caltrans and descriptions of EFH for Pacific Coast salmon (PFMC 2014) contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1. Essential Fish Habitat Affected by the Project

Pacific coast salmon EFH may be adversely affected by the proposed action. Specific habitats identified in the PFMC (2014) for pacific coast salmon include habitat areas of particular concern (HAPCs), identified as: 1) complex channels and floodplain habitats; 2) thermal refugia; and 3) spawning habitat. HAPCs for Chinook salmon include all waters, substrates, and associated biological communities falling within critical habitat areas described above in the accompanying biological opinion for the project located on Mill Creek in the Middle Fork Eel River watershed. Essentially, all CC Chinook salmon habitat located within the proposed action is considered HAPC as defined in PFMC (2014).

3.2. Adverse Effects on Essential Fish Habitat

The potential adverse effects of the Project on EFH have been described in the preceding biological opinion and include disturbance of the channel bed and banks, temporary loss of wetted habitat, and temporary loss of riparian vegetation. Therefore, the effects of the project on ESA-listed species are anticipated to be the same as the effects to EFH in the action area.

3.3. Essential Fish Habitat Conservation Recommendations

Section 305(b)(4)(A) of the MSA authorizes NMFS to provide EFH Conservation Recommendations that will minimize adverse effects of an activity on EFH. Although temporary potential adverse effects are anticipated as a result of the project activities, the proposed minimization and avoidance measures, and best management practices in the accompanying biological opinion are sufficient to avoid, minimize, and/or mitigate for the anticipated affects. Therefore, no additional EFH Conservation Recommendations are necessary at this time that would otherwise offset the adverse effects to EFH.

3.4. Supplemental Consultation

Caltrans must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that effects the basis for NMFS' EFH Conservation Recommendations (50 CFR600.920(1)).

4. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

4.1. Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion is the California Department of Transportation (Caltrans) and the Mendocino County Department of Transportation and individual copies of this opinion were provided to Caltrans. The format and naming adheres to conventional standards for style.

4.2. Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

4.3. Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion [and EFH consultation, contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

5. REFERENCES

Articles, Manuscripts, and Personal Communications

Abdul-Aziz, O. I, N. J. Mantua, K. W. Myers. 2011. Potential climate change impacts on thermal habitats of Pacific salmon (*Oncorhynchus* spp.) in the North Pacific Ocean and adjacent seas. Canadian Journal of Fisheries and Aquatic Sciences 68(9):1660-1680.

Beauchamp, D.A., M.F. Shepard, and G.B. Pauley. 1983. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Northwest) Chinook salmon. U.S. Fish and Wildlife. Service, Division of Biological Services, FWS/OBS-82/11.6. U.S. Army Corps of Engineers, TR EL-82-4. 15 pp.

Berg, L., and T.G. Northcote. 1985. Changes in territorial, gill-flaring, and feeding behavior in juvenile coho salmon *(Oncorhynchus kisutch)* following short-term pulses of suspended sediment. Canadian Journal of Fisheries and Aquatic Sciences 42:1410-1417.

Bjorkstedt, E.P., B.C. Spence, J.C. Garza, D.G. Hankin, D. Fuller, W.E. Jones, J.J. Smith, and R. Macedo. 2005. An analysis of historical population structure for evolutionarily significant units of Chinook salmon, coho salmon, and steelhead in the north-central California coast recovery domain. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center. 210 pages.

Bjornn, T.C. and D.W. Reiser (1991). Habitat requirements of salmonids in W.R. Meehan (ed.), Influence of forest and rangeland management on salmonids fishes and their habitats. Special Publication 19. Bethesda, MD: American Fisheries Society.

Bjornn, T. C., *et al.* (1977). Transport of granitic sediment in streams and its effect on insects and fish. Moscow, ID, University of Idaho, College of Forestry, wildlife and Range Sciences: 43.

Bjornn, T.C. and D.W. Reiser (1991). Habitat requirements of salmonids in W.R. Meehan (ed.), Influence of forest and rangeland management on salmonids fishes and their habitats. Special Publication 19. Bethesda, MD: American Fisheries Society.

Brewer, P.G. and J. Barry. 2008. Rising Acidity in the Ocean: The Other CO2 Problem. Scientific American. October 7, 2008.

Bustard, D.R. and D.W. Narver (1975). Aspects of the winter ecology of juvenile coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Salmo gairdneri*). Journal of the Fisheries Research Board of Canada 32: 667-680.

Burgner, R.L., J.T. Light, L. Margolis, T. Okazaki, A. Tautz, and S. Ito (1992). Distribution and origins of steelhead trout in offshore waters of the North Pacific Ocean. International North Pacific Fisheries Commission, Bulletin 51, Vancouver, B.C.

Busby, P.J., T.C. Wainwright, G.J. Bryant, L. Lierheimer, R.S. Waples, F.W. Waknitz, and I.V. Lagomarsino (1996). Status review of West Coast steelhead from Washington, Idaho, Oregon and California. United States Department of Commerce, National Oceanic and Atmospheric Administration Technical Memorandum NMFS-NWFSC-27.

Caltrans. 2020. Hill Road Bridge at Mill Creek Bridge Replacement Project Biological Assessment, Mendocino County Bridge No. 10C0111. Federal Aid Project Number: BRLO5910 (084). Prepared by: County of Mendocino Department of Transportation 340 Lake Mendocino Drive, Ukiah, CA 95482. Prepared for: Caltrans Office of Local Assistance District 1/North Region Caltrans District 1, P.O. Box 3700, Eureka, CA 95502. February 2020.

CDFG (California Department of Fish and Game). 1965 California Fish and Wildlife Plan, Vol. I: Summary. 110p.; Vol. II: Fish and Wildlife Plans, 216.; Vol. III: Supporting Data, 180p.

CDFG (California Department of Fish and Game. 1996. DFG Stream Inventory Report Mill Creek. Inland Fisheries Conservation and Management Division. Sacramento, CA 95605

Chapman, D. W., and T. C. Bjornn (1969). Distribution of salmonids in streams, with special reference to food and feeding. Symposium on Salmon and Trout in Streams; H.R. Macmillan Lectures in Fisheries, University of British Columbia, Institute of Fisheries.

Chase, S. D., D. J. Manning, D. G. Cook, and S. K. White. 2007. Historic accounts, recent abundance, and current distribution of threatened Chinook salmon in the Russian River, California. California Fish and Game 93(3):130.

Chow, Michelle & Lundin, Jessica & Mitchell, Chelsea & Davis, Jay & Young, Graham & Scholz, Nathaniel & McIntyre, Jenifer. (2019). An urban stormwater runoff mortality syndrome in juvenile coho salmon. Aquatic Toxicology. 214. 105231. 10.1016/j.aquatox.2019.105231.

Cloern, J. E., N. Knowles, L. R. Brown, D. Cayan, M. D. Dettinger, T. L.Morgan, D. H. Schoellhamer, M. T. Stacey, M. van der Wegen, R. W. Wagner, and A. D. Jassby. 2011. Projected Evolution of California's San Francisco Bay-Delta-River System in a Century of Climate Change. PLoS ONE 6(9):13.

Collins, C. 2020. Email Correspondence 11-24-2020. Biologist, County of Mendocino Department of Transportation, Ukiah, CA 95482.

Cooper J.R., J.W. Gilliam, R.B. Daniels, and W.P. Robarge (1987). Riparian areas as filters for agricultural sediment. Soil Science Society of America Journal. 51:416–420.

Cordone, A.J., and D.W. Kelley. 1961. The influences of inorganic sediment on the aquatic life of streams. California Fish and Game 47:189-228.

Cox, P., and D. Stephenson. 2007. A changing climate for prediction. Science 113:207-208.

Crouse, M.R., C.A. Callahan, K.W. Malueg, and S.E. Dominguez. 1981. Effects of fine sediments on growth of juvenile coho salmon in laboratory streams. Transactions of the American Fisheries Society 110:281-286.

Cushman, R.M. (1985). Review of ecological effects of rapidly varying flows downstream from hydroelectric facilities. North American Journal of Fisheries Management 5: 330-339.

Doney, S. C, M. Ruckelshaus, J. E. Duffy, J. P. Barry, F. Chan, C. A. English, H. M. Galindo, J. M. Grebmeier, A. B. Hollowed, N. Knowlton, J. Polovina, N. N. Rabalais, W. J. Sydeman, L. D. Talley. 2012. Climate Change Impacts on Marine Ecosystems. Annual Review of Marine Science 4:11-37.

Everest, F.H. and D.W. Chapman (1972). Habitat selection and spatial interaction by juvenile Chinook salmon and steelhead trout. Journal of the Fisheries Research Board of Canada 29:91-100.

Feely, R. A., C. L. Sabine, K. Lee, W. Berelson, J. Kleypas, V. J. Fabry, and F. J. Millero. 2004. Impact of anthropogenic CO2 on the CaCO3 system in the oceans. Science 305, 362-366.

FHWG (Fisheries Hydroacoustic Working Group). 2008. Agreement in principal for interim criteria for injury to fish from pile driving activities. Memorandum dated June 12, 2008.

Garza, J.C., Pease D. E. 2008. Population Genetics of Oncorhynchus mykiss in the Santa Clara Valley Region. 53p.

Good, T. P., R. S. Waples, and P. B. Adams. 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-66.

Gregory, R., and T. Northcote 1993. Surface, planktonic, and benthic foraging by juvenile chinook salmon (*Oncorhynchus tshawytscha*) in turbid laboratory conditions. Canadian Journal of Fisheries and Aquatic Sciences 50(2):233-240.

Harvey, B. C. (1986). "Effects of Suction Gold Dredging on Fish and Invertebrates in Two California Streams." North American Journal of Fisheries Management 6(3): 401-409.

Hassler, T. J. 1987. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Pacific Southwest) coho salmon. U.S. Fish and Wildlife Service, Biological Report. 82(11.70). U.S. Army Corps of Engineers, TR EL.

Hayes, M.L. 1983. Active Capture Techniques. Pages 123-146 *in* L.A. Nielsen and D.L. Johnson, eds. Fisheries Techniques. American Fisheries Society. Bethesda, Maryland. 468 pages.

Hayhoe, K., D. Cayan, C. B. Field, P. C. Frumhoff, E. P. Maurer, N. L. Miller, S. C. Moser, S. H. Schneider, K. N. Cahill, E. E. Cleland, L. Dale, R. Drapek, R. M. Hanemann, L. S. Kalkstein, J. Lenihan, C. K. Lunch, R. P. Neilson, S. C. Sheridan, and J. H. Verville. 2004. Emissions pathways, climate change, and impacts on California. Proceedings of the National Academy of Sciences of the United States of America, volume 101: 12422-12427.

Healey, M.C. 1991. Life history of Chinook salmon (Oncorhynchus tshawytscha). Pages 396-445 in C. Groot and L. Margolis, editors. Pacific Salmon Life Histories. University of British Columbia Press, Vancouver, British Columbia.

Hokanson, K.E.F., C.F. Kleiner, and T.W. Thorslund (1977). Effects of constant temperatures and diel temperature fluctuations on specific growth and mortality rates and yield of juvenile rainbow trout, *Salmo gairdneri*. Journal of the Fisheries Research Board of Canada 34: 639- 648.

Hubert, W.A. (1996). Passive capture techniques. In B. Murphy and D. Willis (eds.) Fisheries Techniques. Bethesda, Maryland, American Fisheries Society.

Jahn, J. 2004. Personal communication. Fisheries biologist. NMFS, Protected Resources Division, Santa Rosa, California.

Kadir, T., L. Mazur, C. Milanes, and K. Randles. 2013. Indicators of Climate Change in California. California Environmental Protection Agency, Office of Environmental Health Hazard Assessment Sacramento, CA

Keeley, E.R. (2003). An experimental analysis of self-thinning in juvenile steelhead trout. Oikos 102: 543-550.

Leidy, R.A., and G.R. Leidy. 1984. Life stage periodicities of anadromous salmonids in the Klamath River basin, Northwestern California. United States Fish and Wildlife Service, Sacramento, California.

Lindley, S. T., R. S. Schick, E. Mora, P. B. Adams, J. J. Anderson, S. Greene, C. Hanson, B. P. May, D. R. McEwan, R. B. MacFarlane, C. Swanson, and J. G. Williams. 2007. Framework for assessing viability of threatened and endangered Chinook salmon and steelhead in the Sacramento-San Joaquin Basin. San Francisco Estuary and Watershed Science, 5.

Linton T.L., A.M. Landry, Jr, J.E. Buckner, Jr, and R.L. Berry. 1985. "Effects upon selected marine organisms of explosives used for sound production in geophysical exploration." Texas Journal of Science 37:342–353.

Lisle, T.E. (1986). Effects of woody debris on anadromous salmonid habitat, Prince of Wales Island, Southeast Alaska. North American Journal of Fisheries Management 6: 538-550.

McElhany, P., M. H. Rucklelshaus, M. J. Ford, T. C. Wainwright, and E. P. Bjorkstedt. 2000. Viable Salmonid Populations and the Recovery of Evolutionarily Significant Units. United States Department of Commerce, National Oceanic and Atmospheric Administration Technical Memorandum NMFS-NWFSC-42. 156 pages.

McIntyre, J.K., J.W. Davis, C. Hinman, K.H. Macneale, B.F. Anulacion, N.L. Scholz, and J.D. Stark. 2015. Soil bioretention protects juvenile salmon and their prey from the toxic impacts of urban stormwater runoff. Chemosphere 132 (2015) 213-219.

Mitchell W. 2020. Personal Communication. SHN Consulting Engineers & Geologists Inc., Willits CA.

Mitsch, W.J. and J.G. Gosselink (2000). Wetlands, 3rd ed. John Wiley & Sons, New York.

Moyle, P.B. (2002). Inland fishes of California. University of California Press, Berekely and Los Angeles, CA.

Moyle, P.B., JA. Israel, and SE. Purdy (2008). Salmon, steelhead, and trout in California: Status of an emblematic fauna. Report commissioned by California Trout. University of California Davis Center for Watershed Sciences, Davis, CA.

Moser, S., J. Ekstrom, and G. Franco. 2012. Our Changing Climate 2012 Vulnerability and Adaptation to the Increasing Risks from Climate Change in California. A Summary Report on the Third Assessment from the California Climate change Center. July. CEC-500-20102-007S.

Murphy, M.L. and W.R. Meehan (1991). Stream ecosystems. In W.R. Meehan (ed.) Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society, Special Publication Number 19**:** 17-46

Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, W.S. Grand, F.W. Waknitz, K. Neely, S.T. Lindley, and R.S. Waples. 1998. Status review of Chinook salmon from Washington, Idaho, Oregon, and California. United States Department of Commerce, National Oceanic and Atmospheric Administration Technical Memorandum NMFS-NWFSC-35.

Myrick, C. and J.J. Cech, Jr. (2005). Effects of temperature on the growth, food consumption, and thermal tolerance of age-0 Nimbus-strain steelhead. North American Journal of Aquaculture 67:324-330.

NMFS (National Marine Fisheries Service). 1997. Status review update for West Coast steelhead from Washington, Idaho, Oregon and California. United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. 68 p.

NMFS (National Marine Fisheries Service). (2000). Guidelines for electrofishing waters containing salmonids listed under the Endangered Species Act. National Marine Fisheries Service, Protected Resources Division, Santa Rosa, California.

NMFS (National Marine Fisheries Service). 2011. North-Central California Coast Recovery Domain 5-Year Review: Summary and Evaluation of California Coastal Chinook Salmon ESU and Central California Coast Coho Salmon ESU. Southwest Region. 54 pages.

NMFS (National Marine Fisheries Service). 2014. Final Recovery Plan for the Southern Oregon/Northern California Coast Evolutionarily Significant Unit of Coho Salmon (Oncorhynchus *kisutch*). National Marine Fisheries Service. Arcata, CA.

NMFS (National Marine Fisheries Service). 2016. 5-Year Review: Summary and Evaluation of South-Central California Coast Steelhead Distinct Population Segment. National Marine Fisheries Service. West Coast Region. California Coastal Office. Santa Rosa, California.

NMFS (National Marine Fisheries Service). 2015. NOAA Fisheries Service Coastal Multispecies Recovery Plan Public Draft. California Coast Chinook Salmon, Northern California Steelhead, Central California Coast Steelhead. October 2015.

NMFS (National Marine Fisheries Service). 2016. Final Coastal Multispecies Recovery Plan. National Marine Fisheries Service, West Coast Region, Santa Rosa, California.

Nielson, J.L. and M.C. Fountain (2006). Microsatellite diversity in sympatric reproductive ecotypes of Pacific steelhead (*Oncorhynchus mykiss*) from the Middle Fork Eel River, California. Ecology of Freshwater Fish 8: 159-168.

Osgood, K.E. (editor). 2008. Climate Impacts on U.S. Living Marine Resources: National Marine Fisheries Service Concerns, Activities and Needs. U.S. Dep. Commerce, NOAA Tech. Memo. NMFSF/ SPO-89, 118 p.

Osterback, A.K., C.H. Kern, E.A. Kanawi, J.M. Perez, and J.D. Kiernan (2018). The effects of early sandbar formation on the abundance and ecology of coho salmon (*Oncorhynchus kisutch*) and steelhead trout (*Oncorhynchus mykiss*) in a Central California coastal lagoon. Canadian Journal of Fisheries and Aquatic Sciences.

PFMC. 2014. Appendix A to the Pacific Coast Salmon Fishery Management Plan, as modified by Amendment 18. Identification and description of essential fish habitat, adverse impacts, and recommended conservation measures for salmon.

Poole, G.C. and C.H. Berman (2001). An ecological perspective on in-stream temperature: natural heat dynamics and mechanisms of human-caused thermal degradation. Environmental Management 27: 787-802.

Rau and Associates Inc. 2014. Conceptual Drainage Assessment. Covelo/Round Valley Non-Motorized Needs Assessment and Engineered Needs Feasibility Study. Prepared for: Caltrans and Mendocino Council of Governments. Prepared by: Rau and Associates Inc., Ukiah California. November 2013.

Reiser, D.W., and T.C. Bjornn. 1979. Habitat requirements of anadromous salmonids. General Technical Report PNW-96. United States Department of Agriculture, Forest Service.

Ruggiero, P., C. A. Brown, P. D. Komar, J. C. Allan, D. A. Reusser, H. Lee, S. S. Rumrill, P. Corcoran, H. Baron, H. Moritz, J. Saarinen. 2010. Impacts of climate change on Oregon's coasts and estuaries. Pages 241-256 in K.D. Dellow and P. W. Mote, editors. Oregon Climate Assessment Report. College of Oceanic and Atmospheric Sciences, Oregon State University, Corvallis, Oregon.

Santer, B.D., C. Mears, C. Doutriaux, P. Caldwell, P.J. Gleckler, T.M.L. Wigley, S. Solomon, N.P. Gillett, D. Ivanova, T.R. Karl, J.R. Lanzante, G.A. Meehl, P.A. Stott, K.E. Talyor, P.W. Thorne, M.F. Wehner, and F.J. Wentz. 2011. Separating signal and noise in atmospheric temperature changes: The importance of timescale. Journal of Geophysical Research 116: D22105.

Satterthwaite, W.H., M.P. Beakes, E.M. Collins, D.R. Swank, J.E. Merz, R.G. Titus, S.M. Sogard, and M. Mangel (2009). Steelhead life history on California's Central Coast: Insights from a state-dependent model. Transactions of the American Fisheries Society 138: 532–548.

Scavia, D., J.C. Field, D.F. Boesch, R.W. Buddemeier, V. Burkett, D.R. Cayan, M. Fogarty, M.A. Harwell, R.W. Howarth, C. Mason, D.J. Reed, T.C. Royer, A.H. Sallenger, and J.G. Titus. 2002. Climate Change Impacts on U.S. Coastal and Marine Ecosystems. Estuaries, volume 25(2): 149-164.

Seghesio, E., and D. Wilson. 2016. 2016 5-year review: summary and evaluation of California Coastal Chinook salmon and Northern California Steelhead. National Marine Fisheries Service West Coast Region. April 2016.

Shapovalov, L., and A. C. Taft (1954). "The life histories of the steelhead rainbow trout (*Salmo gairdneri gairdneri*) and silver salmon (*Oncorhynchus kisutch*) with special reference to

Waddell Creek, California, and recommendations regarding their management." Fish Bulletin 98.

Scholz N.L., M.S. Myers, S.G. McCarthy, J.S. Labenia, J.K. McIntyre, and G.M. Ylitalo. (2011) Recurrent Die-Offs of Adult Coho Salmon Returning to Spawn in Puget Sound Lowland Urban Streams. PLoS ONE 6(12): e28013. https://doi.org/10.1371/journal.pone.0028013

Smith, A.K. (1973). Development and application of spawning velocity and depth criteria for Oregon salmonids. Transactions of the American Fisheries Society 102:312- 316.

Smith, J.J. and H. Li, W. (1983). Energetic factors influencing foraging tactics of juvenile steelhead trout, *Salmo gairdneri*. In: D.L.G. Noakes, D.G. Lingquist, G.S. Helfman, and J.A. Ward (eds.) Predators and prey in fishes. The Hague, The Netherlands.

Schneider, S.H. 2007. The unique risks to California from human-induced climate change. California State Motor Vehicle Pollution Control Standards; Request for Waiver of Federal Preemption, presentation May 22, 2007.

Sogard, S.M., J.E. Merz, W.H. Satterthwaite, M.P. Beakes, D.R. Swank, E.M. Collins, R.G. Titus, and M. Mangel (2012). Contrasts in habitat characteristics and life history patterns of *Oncorhynchus mykiss* in California's Central Coast and Central Valley. Transactions of the American Fisheries Society 141:747–760.

Spence, B.C. 2016. North-Central California Coast Recovery Domain. Pages 32–82 in T.H. Williams, B.C. Spence, D.A. Boughton, R.C. Johnson, L.G. Crozier, N.J. Mantua, M.R. O'Farrell, and S.T. Lindley. Viability assessment for Pacific salmon and steelhead listed under the Endangered Species Act: Southwest. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SWFSC-564.

Sutton, R., L.D. Sedlak, M. Box, C. Gilbreath, A. Holleman, R. Miller, L. Wong, A. Munno, K. X, Zhu, C. Rochman. 2019. Understanding Microplastic Levels, Pathways, and Transport in the San Francisco Bay Region, SFEI-ASC Publication #950, October 2019, 402 pages. SWFSC (Southwest Fisheries Science Center). 2008. Coho and Chinook salmon decline in California during the spawning seasons of 2007/2008. R.B. MacFarlane, S. Hayes, and B. Wells. Southwest Fisheries Science Center. Internal memorandum for NMFS. February 2.

Thrower, F.P., J.J. Hard, and J.E. Joyce (2004). Genetic architecture of growth and early life-history transitions in anadromous and derived freshwater populations of steelhead. Journal of Fish Biology. 65: 286-307.

Tian Z., H. Zhao, K.T. Peter, M. Gonzalez, J. Wetzel, C. Wu, X. Hu, J. Prat, E.Mudrock, R. Hettinger, A. E. Cortina, R.G. Biswas, F.V.C Kock, R. Soong, A. Jenne, B. Du, F. Hou, H. He, R. Lundeen, A. Gibreath, R. Sutten, N.L. Scholz, J.W. Davis, M.C. Dodd, A. Simpson, J.K. McIntyre, and E.P. Kolodziej. 2020. A ubiquitous tire rubber-derived chemical induces acute mortality in coho salmon, Science 10.1126/science.abd6951.

Turley, C. 2008. Impacts of changing ocean chemistry in a high-CO2 world. Mineralogical Magazine, February 2008, 72(1). 359-362.

U.S. Environmental Protection Agency (USEPA) (2001). Issue Paper 5: Summary of technical literature examining the effects of temperature on salmonids. Region 10, Seattle, WA. EPA 910-D-01-005.

Weitkamp, L.A., T.C. Wainwright, G.J. Bryant, G.B. Milner, D.J. Teel, R.G. Kope, and R.S. Waples. 1995. Status review of coho salmon from Washington, Oregon, and California. United States Department of Commerce, National Oceanic and Atmospheric Administration Technical Memorandum NMFS-NWFSC-24. 258 pages.

Westerling, A. L., B. P. Bryant, H. K. Preisler, T. P. Holmes, H. G. Hidalgo, T. Das, and S. R. Shrestha. 2011. Climate change and growth scenarios for California wildfire. Climate Change 109(1):445-463.

Williams, T.H. S.T. Lindley, B.C. Spence, and D. A. Boughton. 2011. Status Review Update for Pacific Salmon and Steelhead Listed under the Endangered Species Act: Southwest 17 May 2011 – Update to 5 January 2011 report. National Marine Fisheries Service Southwest Fisheries Science Center. Santa Cruz. CA.

Wurtsbaugh, W.A. and G.E. Davis (1977). Effects of temperature and ration level on the growth and food conversion efficiency of *Salmo gairdneri*, Richardson. Journal of Fish Biology 11:87-98.

Zedonis, P.A. and T.J. Newcomb (1997). An evaluation of flow and water temperatures during the spring for protection of salmon and steelhead smolts in the Trinity River, California. United States Fish and Wildlife Service, Arcata, CA.

<u>Federal Register Notices</u>

62 FR 43937: National Marine Fisheries Service. Final Rule: Listing of Several Evolutionary Significant Units of West Coast Steelhead. Federal Register 62:43937-43954. August 18, 1997.

64 FR 24049: National Marine Fisheries Service. Final Rule and Correction: Designated Critical Habitat for Central California Coast Coho and Southern Oregon/Northern California Coast Coho Salmon. Federal Register 64:24049-24062. May 5, 1999.

65 FR 36074. June 7, 2000. Endangered and threatened species: Threatened status for one steelhead Evolutionarily Significant Unit (ESU) in California. United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service; Final Rule. Federal Register, Volume 65.

70 FR 37160: National Marine Fisheries Service. Final Rule: Final Listing Determinations for 16 ESUs of West Coast Salmon, and Final 4(d) Protective Regulations for Threatened Salmonid ESUs. Federal Register 70:37160-37204. June 28, 2005.

70 FR 52488: Endangered and Threatened Species; Designation of Critical Habitat for Seven Evolutionarily Significant Units of Pacific Salmon and Steelhead in California; Final Rule. Federal Register 70:52488-52536. September 2, 2005.

71 FR 834: National Marine Fisheries Service. Final rule: Listing Determinations for 10 Distinct Population Segments of West Coast Steelhead. Federal Register 71:834-862. January 5, 2006.

76 FR 50447. August 15, 2011. Notice of availability of 5-year reviews: Endangered and Threatened Species; 5-Year Reviews for 5 Evolutionarily Significant 96 Units of Pacific Salmon and 1 Distinct Population Segment of Steelhead in California. United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Federal Register, 76: 50447-50448.

81 FR 7214: National Marine Fisheries Service. Interagency Cooperation-Endangered Species Act of 1973, as Amended; Definition of Destruction or Adverse Modification of Critical Habitat. Federal Register Volume 81: 7214-7226. February 16, 2011.

84 FR 44976: U.S. Fish and Wildlife Service (FWS), Interior; National Marine Fisheries Service (NMFS), National Oceanic and Atmospheric Administration, Commerce. Final Rule. Endangered and Threatened Wildlife and Plants; Regulations for Interagency Cooperation. Federal Register Volume 84: 44976-45018. August 27, 2019.