

**A Biological Assessment of Impacts to
Threatened Anadromous Salmonids from the
2010 Redwood National Park Fire Management Plan and
Prescribed Burning in Prairie Creek Redwoods and
Jedediah Smith Redwoods State Parks in
Redwood National and State Parks (RNSP)**

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Date:
4 August 2009

I. INTRODUCTION

The purpose of this biological assessment (BA) is to review the proposed Redwood National Park (RNP) 2010 Fire Management Plan (FMP) and Prescribed Burning in Jedediah Smith Redwoods and Prairie Creek Redwoods State Parks to determine if the proposed actions may affect any threatened or endangered species and/or their critical habitats. This biological assessment is prepared in accordance with legal requirements set forth under section 7 of the Endangered Species Act (19 U.S.C. 1536 (c), 50 CFR 402), and meets the criteria for formal consultation with NOAA Fisheries. This document also meets the requirements of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1801 et. seq) essential fishery habitat (EFH) consultation requirements (sec. 305 (b)(2) and 305 (b)(4)(B)) and ESA/EFH parallel consultation guidelines established by NOAA Fisheries (USDC 1999c, USDC 2001). The 2010 Fire Management Plan and state park actions are expected to be effective through 2015.

II. CONSULTATION TO DATE

RNSP currently has three species of anadromous salmonids belonging to three different evolutionary significant units (ESU) that are listed as threatened under the Endangered Species Act:

1. California Coastal (CC) Chinook Salmon (*Oncorhynchus tshawytscha*) (USDC 1999a.)
2. Northern California (NC) Steelhead (*Oncorhynchus mykiss*) (USDC 2000)
3. Southern Oregon/Northern California Coasts (SONCC) Coho Salmon (USDC (*Oncorhynchus kisutch*) (USDC 1999b)

Critical habitat is currently designated for all three species.

Previous Pertinent Consultations

The first previous pertinent consultation on many similar fire management proposed actions to those proposed in the 2010 RNP FMP was completed in 2002. The subsequent letter of concurrence from NOAA Fisheries was dated 10 June 2002 (NOAA Fisheries Administrative File # 51422SWR02AR6328).

A second previous consultation that was very similar or in many cases identical to the fire management proposed actions described in the 2010 RNP FMP was completed in January 2005. The subsequent letter of concurrence from NOAA Fisheries was dated 21 January 2005 (NOAA Fisheries Administrative File # 151422SWR04AR9140:BW).

A large number of verbal and written communications were associated with the past consultation efforts. All pertinent NOAA Fisheries recommendations and concerns from the past consultations have been incorporated into this project.

Current Consultation

An interagency consultation team meeting was held on 10 February 2009 and was attended by Keith Bensen, Leonel Arguello, John McClelland, Rick L. Young, and Jeff Ayers representing Redwood National Park fire management, Shari Anderson of NOAA Fisheries as well as various other park resource managers and representatives of other state and federal regulatory agencies. The proposed

action was described and preliminary determinations and additional information needs were outlined. A field trip was taken to view a previous second growth prescribed burn unit and to see the proposed Wildcat second growth prescribed burn unit by Keith Bensen, Shari Anderson and Dan Free (NOAA Fisheries) on 12 March 2009. Pre and post prescribed burn stream sedimentation monitoring needs were discussed. A draft biological assessment was sent to the NOAA Fisheries on 8 June 2009 and comments were received on 22 June 2009

III. CURRENT MANAGEMENT DIRECTION

RNSP is located in Humboldt and Del Norte Counties in northwestern California and encompass 105,516 acres of land. Numerous federal and state laws, regulations, and policies guide management.

The National Park Service (NPS) Organic Act of 1916 states that national parks will be managed “to conserve the scenery and the natural and historic objects, and the wildlife therein, and to provide for the enjoyment of the same in such a manner and by such means as will leave them unimpaired for the enjoyment of future generations.”

The management of Redwood National Park is guided by the 1968 enabling legislation (PL 90-545) in which Congress established the Park to preserve significant examples of primeval coast redwood forest, and the streams and seashores with which they are associated, for purposes of public inspiration, enjoyment, and scientific study. The 1978 park expansion legislation (PL 95-250) added lands to create a more meaningful park for the use and enjoyment of the visitors, and directed the NPS to implement a watershed rehabilitation program to reduce erosion caused primarily by roads built in association with timber harvest. Title 36, *Code of Federal Regulations*, Parts 1 through 7 gives the park Superintendent discretionary authority regarding designations, closures, permits, and miscellaneous restrictions. These items are described in a compendium that provides direction for a wide variety of public activities that may occur within the national park.

The *California Public Resources Code* (sec. 5019.53 et seq.) prescribes general management policies for the state parks that include preservation of “outstanding natural, scenic, and cultural values, indigenous aquatic and terrestrial fauna and flora, and the most significant example of such ecological regions of California as the...coastal strip...redwoods...foothills and low coastal mountains...”. Additionally, the California Park and Recreation Commission established declarations of purpose for each of the three state parks (Jedediah Smith Redwoods, Del Norte Coast Redwoods, and Prairie Creek Redwoods State Parks) that direct that scenic, historic, and scientific values within the parks are to be preserved.

The *General Management Plan/General Plan and Environmental Impact Statement/Report for Redwood National and State Parks* (USDI and CDPR 1999) provides comprehensive guidance for managing the national and state parks as one complex with similar resources. The General Management Plan/ General Plan (GMP) provides overall vision and direction for the parks and identifies future planning needs. Under the GMP, the agencies will emphasize the protection of resources and will also provide a variety of opportunities for visitors to enjoy the parks. New visitor services and facilities will be provided to enhance the visitor experience if these services and facilities do not impact sensitive resources. The park agencies will cooperate with adjacent communities and landowners, local American Indian tribes, and other government agencies to accomplish long-range resource management planning to reduce threats to RNSP resources. Hiking, mountain biking, and camping are currently important components of the

activities available to people that visit RNSP. No areas within RNSP are closed to visitor use but many areas are managed to exclude public use of motor vehicles and bicycles.

The GMP identifies individual action plans needed to address specific RNSP actions such as estuary, second growth, trail, fire and fuels, vegetation, back-country visitor use, and transportation management. Relative to management of listed threatened and endangered species the GMP directs RNSP staff to "...avoid, minimize, rectify, reduce, compensate, or otherwise mitigate any potential adverse impacts on state or federally listed or proposed or candidate threatened or endangered species...." in association with construction, visitor use, or restoration activities (GMP p. 37). These actions will be achieved primarily by restricting work temporally and spatially so as not to disturb T&E species and by designating almost one-third of the RNSP as "primitive" zones where disturbance to all species from human activities would be limited to those "...necessary to restore and maintain ecosystem function" (GMP p. 38).

The National Park Service signed the Interagency Memorandum of Understanding implementing the *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl* (USDA and USDI 1994; Northwest Forest Plan ROD). National Park lands within the range of the northern spotted owl are designated as congressionally reserved. RNSP are managed using an ecosystem management strategy, similar to the strategy presented in the Northwest Forest Plan ROD. Implementation of RNSP operations consistent with federal and state enabling legislation (i.e., to preserve, and restore where needed, the old-growth forest ecosystem) will augment the lands designated as Riparian and Late Successional Reserves on other nearby federal lands. RNSP policies and guidelines relative to watershed restoration are similar to those outlined by the Aquatic Conservation Strategy in the Northwest Forest Plan ROD.

Section 7(a)1 of the Endangered Species Act (ESA) of 1973, as amended, requires that federal agencies utilize their authorities in furtherance of the purposes of the ESA by carrying out programs for the conservation of endangered and threatened species. Section 7(a)2 of the ESA requires that a federal agency, in consultation with and with the assistance of the Secretary of the Interior, ensures that any action it authorizes, funds, or carries out is not likely to jeopardize the continued existence of any listed species or results in the destruction or adverse modification of critical habitat. Specific management direction for each of the listed threatened, endangered, or proposed species considered in this document is reviewed in Section V, "Status and Distribution of Listed Species".

IV. DESCRIPTION OF THE PROPOSED ACTION

A. Redwood National Park 2010 Fire Management Plan

The 2010 Redwood National Park Fire Management Plan is expected to be effective through 2015.

1) Wildfire Suppression

Guidelines were developed as part of the Redwood National Park 2010 Fire Management Plan to potentially reduce or eliminate impacts to threatened, endangered and candidate species as well as non listed fish and wildlife from wildfire suppression activities (Appendix 1). These wildfire suppression guidelines are only guidelines, *not proposed actions*. The unpredictability of wildfires and the subsequent

potential threats to human safety and significant resources could possibly dictate wildfire suppression tactics that would possibly overrule some or all of the recommendations in the guidelines. This unpredictability prevents any meaningful analysis from being conducted. *Any wildfire suppression tactics and activities, therefore, will be analyzed under emergency consultation procedures and will not be mentioned further in this document.*

2) Prescribed Burning in Prairies (Grasslands), Oak Woodlands, Pine Woodlands and Second Growth Coniferous Forest

Prescribed fire will be used to treat approximately 4,591 acres of prairie, oak woodland and pine woodland. Specific areas or “burn units” and their relative distance to anadromous salmonid habitat are listed below in Table 1. No units contain a perennial stream within the unit boundaries. Burn unit locations are described in Appendix 2, Maps 1 and 2.

Table 1. Prescribed burn units and number of perennial and intermittent streams contained within each (from RNP GIS database). Prescribed burn start dates vary between units due to proximity to potentially suitable habitat of listed terrestrial species or migratory birds.

Burn Unit Name*	Acres	Time of year burning proposed	Number of intermittent streams w/in 100 feet of burn unit	Number of perennial streams w/in 150 feet of burn unit	Number of perennial streams w/in 300 feet of burn unit
Airstrip, Lower ¹	110	August 1 st to first rains	1	0	1
Airstrip, Upper ¹	102	August 1 st to first rains	0	0	0
C-10 ⁴	339	September 16 th to first rains	3	0	0
Child’s Hill ¹	561	August 1 st to first rains	3	0	0
Copper Creek ¹	148	August 1 st to first rains	2	0	0
Counts, Upper ¹	118	August 1 st to first rains	1	0	0
Counts, Lower ¹	220	September 16 th to first rains	1	0	1
Coyote Creek ²	1,063	September 16 th to first rains	5	0	0
Davison ¹	10	September 16 th to first rains	0	0	1
DeMartin ²	5	September 16 th to first rains	0	0	0
Dolason, Lower ²	220	September 16 th to first rains	0	0	0

Burn Unit Name*	Acres	Time of year burning proposed	Number of intermittent streams w/in 100 feet of burn unit	Number of perennial streams w/in 150 feet of burn unit	Number of perennial streams w/in 300 feet of burn unit
Dolason, Upper ²	94	September 16 th to first rains	0	0	0
Dooleyville ²	111	September 16 th to first rains	1	0	1
Eastside ¹	107	August 1 st to first rains	0	0	0
Elk Camp, Lower ¹	244	September 16 th to first rains	1	0	0
Elk Camp, Upper ¹	37	August 1 st to first rains	0	0	0
Enderts ⁵	109	August 1 st to first rains	1	0	0
Gans, Lower ¹	7	September 16 th to first rains	0	0	0
Gans, Upper ¹	17	September 16 th to first rains	0	0	0
Holter Ridge Beargrass ⁴	5	September 16 th to first rains	0	0	0
Lagoon Creek ⁵	68	September 16 th to first rains	0	1*	0
Little Bald Hills ³	1,470 ^a	August 1 st to first rains	6	0	0
Lyons, Lower ²	143	August 1 st to first rains	2	0	0
Lyons, Upper ²	208	August 1 st to first rains	0	0	0
Mainstem ¹	166	August 1 st or September 15 th to first rains	2	0	1
Major Creek ⁵	7	August 1 st to first rains	0	1*	1*
Maneze ²	226	August 1 st to first rains	0	0	0
Mid Basin ²	129	August 1 st to first rains	3	0	0
Pig Pen ¹	69	September 16 th to first rains	0	1	1
School House ¹	300	August 1 st to first rains	0	0	0

Burn Unit Name*	Acres	Time of year burning proposed	Number of intermittent streams w/in 100 feet of burn unit	Number of perennial streams w/in 150 feet of burn unit	Number of perennial streams w/in 300 feet of burn unit
South Boundary ¹	86	September 16 th to first rains	1	0	0
Tick ¹	34	September 16 th to first rains	0	0	0
Upper K&K ⁴	40	September 16 th to first rains	0	0	0
Wildcat ⁴	1,054	September 16 th to first rains	6	1	0
Williams Ridge ¹	118	August 1 st to first rains	0	0	0
Wooden Gate ¹	243	August 1 st to first rains	0	0	0

Vegetation type within unit: ¹grassland, ²grassland and oak woodland, ³Jeffrey pine woodland, ⁴second growth conifer, ⁵coastal grass and scrub.

*Non anadromous watershed.

^aOnly 50 acres within the larger prescribed burn planning unit will be burned per year.

Preparation methods will include cutting grass with line trimmers and mowers along fire lines, fire line construction with chainsaws and hand tools, installation of fire hoses and setting up and filling portable water tanks at strategic locations. Fire line construction will vary according to fuel type and time of year to ensure firefighter safety and allow for control of the prescribed fire. Burns completed late in the year that are dependent upon precipitation will utilize “wet” lines of either naturally occurring forest edge fuel moisture changes or through the direct application of water to vegetation prior to ignition. Where fire lines are constructed they will be dug to mineral soil to a width of no more than four feet. These will be rehabilitated after the prescribed burn by replacing the topsoil. Any fire lines which cross riparian areas will have water bars installed within 300 feet of any intermittent or perennial stream. No shading riparian vegetation will be removed during fire line construction, only understory shrubs and trees and low hanging branches will be removed. Existing canopy cover will be maintained along all riparian areas within 300 feet of any intermittent or perennial stream. In grasslands additional mowing of fuels adjacent to the fire line may occur, while in oak woodlands or areas bordered by dense, young conifers, adjacent ladder fuels will be cleared (i.e. brush cut back, lower limbs removed, small diameter seedlings/pole sized trees cut). In second growth units, small pole sized trees within four feet of fire lines may be cut and limbs of larger trees removed up to six feet above ground. No conifers greater than 18 inches DBH will be cut in any unit. In units with established roads, feller bunchers or a variation on such heavy equipment may be used to fell trees along road sides instead of hand crews with chainsaws. Debris will be scattered within the burn unit when feasible or hand piled and burned during the winter wet season in areas of

heavier accumulation. No piles will be burned within the riparian area (i.e. within 300 feet) of any intermittent or perennial stream.

Treatment prescriptions will vary among unit prescribed fire plans in order to meet specific unit objectives. Prescriptions will include flame lengths between 1 and 27 feet, and rates of spread between 3 and 60 chains per hour. Ignition will be accomplished using drip torches, fusees, and aerial ignition. The personnel committed to each burn may include up to 15 to 20 overhead positions, two handcrews, four engines, one helicopter, one water tender, portable tanks and pumps, hose and related equipment. No water will be drafted from anadromous fish bearing streams.

All structures (historic or otherwise) within the burn units will be protected using standard methods including construction of fire lines, fuel reduction and pretreatment with water and/or foam. No foam applications will be made within 300 feet of any intermittent or perennial streams.

Post burn vegetation monitoring will be accomplished in order to ensure burn objectives are achieved. Fire effects plots have been installed in accordance with the procedures outlined in the "NPS Fire Monitoring Handbook" on a random basis in many of the units.

Pre and post burn stream monitoring will occur at the mouth of Copper Creek within the Wildcat prescribed fire unit (see map in Appendix 2). Specifically, pre and post fire data will be collected by using ISCO pumping samplers to collect physical samples and then test for suspended sediment concentration, pH, and organic matter content. Basic physical metrics such as fine sediment in pools and particle size distribution will also be assessed as well as pre and post burn photo stations (R. Klein pers. comm.).

RNSP has in the past and will make every effort to maintain control of all prescribed fires within the parks using the techniques just described. There is, however, the possibility that a prescribed fire could escape control lines. Emergency consultation procedures will be used to address any fire suppression operations which arise from an escaped prescribed fire because of the unpredictable nature of when and where in RNSP these activities might occur. The wildfire suppression guidelines described in Appendix 1 will be utilized in the event of an escaped prescribed fire. Therefore, there will be no further discussion of these actions within this document.

3) Shaded Fuel Breaks

Five shaded fuel breaks will be created or maintained during the life of the 2010 Fire Management Plan: 1) along Holter Ridge Road (aka Lost Man Creek Trail)/B Line Road from the Bald Hills Road north to US Highway 101, 2) along the Bald Hills Road from the Holter Ridge Road junction to Elk Camp Prairie, 3) the Wolf Creek Outdoor School Access Road and housing complex/fire cache, 4) around the Hiouchi park housing and fire cache complex, and 5) around the Howland Hills Outdoor School access road and complex (Appendix 2, Map 2). The reason for the thinning is to provide more secure and defensible park boundaries, defensible spaces around park developments and escape routes in the event of a wildfire. Mechanical thinning will involve cutting trees with chainsaws less than 18 inches DBH as well as brush and tree limbs that could provide ladder fuels into the forest canopy along a 100 foot wide strip along either side of roads or around building complexes. Canopy cover will be maintained above 60% where it exists. Cut trees and limbs will be piled away from live trees and large logs and snags (i.e. logs >36 inches diameter on the wide end and longer than 10 feet and snags >24 inches DBH) within the units or on the roads and either burned during the wet season outside of the burn timing restrictions or chipped

with a mechanical chipper outside of the noise restrictions described below. Thinning may be done with chainsaws or feller bunchers or some mechanical variation. All five of the fuel breaks are located along ridge tops well away from any stream course or are at least 300 feet from the nearest perennial stream.

4) Historic Structure Annual Hazard Fuel Reduction

Seven historic structures, Elk Camp Barn, Dolason Barn, Lyons Ranch Barn and Bunkhouse, Dooleyville Line Shack, Long Ridge Sheepshead, Coyote Creek Barn, and Coyote Creek Cabin have hazardous fuel accumulations (overgrown grass and brush within 40 feet of structures) cleared annually in order to provide some wildfire protection for the structures (Appendix 2, Map 2). All structures are at least 300 feet from any intermittent or perennial stream.

5) Pond Maintenance

Four existing, human-made ponds (formerly used as water sources for livestock or logging operations) will have low growing brush and sapling trees cleared in and around them with line trimmers and chainsaws to improve access and maintain them as firefighting water sources for either prescribed fires, wildfires or both. The four ponds (M-Line, Elk Camp Upper, Elk Camp Lower, and Coyote) (Appendix 2, Map 2) are all located on the upper thirds of watersheds and are fed by small springs. They are all located well upslope of anadromous reaches.

6) Holding Tank Placement

Four 2,500 gallon water tanks will be placed on or near roads close to ridge tops to provide water sources for wild land firefighting (Table 4). The tanks will be fed with rainwater collected by guzzler-like attachments. Most tanks will simply be placed on a gravel base on existing flat ground. Some tanks will require the construction of redwood “decks” to create a flat surface for the tank. No vegetation will be removed or altered during holding tank placement. The locations are along Bridge Creek Road – mile 3.5, Holter Ridge Road South, Little Bald Hills and Ranch Road – Mid Basin (Appendix 2, Map 2).

B. California Department of Parks and Recreation Prescribed Burning

1) Old Growth Forest Units

Two old growth forest units are proposed to be burned during the next five years on California Department of Parks and Recreation (CDPR) land within RNSP. The Boyes Prairie old growth burn unit is 30 acres of old growth redwood dominated forest fronting the edge of the eastern side of the Boyes Prairie grassland unit (see below). The Peterson Memorial Trail old growth burn unit is 3 acres of flat, bottomland redwood dominated forest completely surrounded by foot trails (Appendix 2, Maps 1 and 2). Both units are located on flat ground at least 300 feet from any intermittent or perennial stream (Appendix 2, Maps 1 and 2).

Broadcast burning will be the method of ignition using drip torches or fusees. The prescription for these units calls for a “cool” understory burn with the objective of consuming smaller ground fuels, shrubs and

small trees (< 12 inches DBH). Fire modeling and stand sampling indicates that within the Boyes Prairie old growth burn unit two to six Sitka spruce/western hemlock trees taller than 120 feet will be killed by the fire (see Appendix 3 for fire model and discussion). The Peterson Memorial Trail old growth burn unit is composed entirely of redwood and no trees >12 inches DBH are expected to be killed by the prescribed burn. Large logs (>36 inches in diameter and at least 10 feet long) will be extinguished completely during the initial mop up period to ensure they are not completely consumed. Fire, however, will not be excluded from large logs. Large logs will be allowed to partially burn if they ignite. Fire crews will be supported by at least two engines, temporary water storage tanks, the ability to lay hose to any portion of the burn units and access to a helicopter for water drops in order to ensure control of the prescribed burn.

2) Coastal Scrub Unit

The Ossagon prescribed burn unit is 115 acres of coastal scrub brushland located on an ocean facing slope adjacent to the north end of Gold Bluffs Beach (Appendix 2, Map 2). The unit is not located in a watershed containing anadromous fish.

3) Coastal Grassland Unit

The 166 acre Boyes Prairie grassland burn unit is located on flat ground at least 300 feet from any intermittent or perennial stream (Appendix 2, Map 2). Burning will occur between 16 September and the end of October.

V. STATUS AND DISTRIBUTION OF LISTED SPECIES AND ENVIRONMENTAL BASELINE

1. California Coastal Chinook Salmon (*Oncorhynchus tshawytscha*), Threatened

A. Species Account

Chinook salmon populations have declined along the Pacific coast to the degree that certain evolutionarily significant units (ESUs) were listed as threatened by NOAA Fisheries under the Endangered Species Act (USDC 1999a). Based on the best biological and commercial information available NOAA Fisheries identified 19 ESUs from populations in Washington, Idaho, Oregon, and California. Genetic data were the primary evidence considered for the reproductive isolation criterion, supplemented by inferences about barriers to migration, human-induced changes resulting from artificial propagation, and harvest. Chinook salmon historically ranged as far south as the Ventura River, California, and north as far as the Russian Far East (USDC 1999a). The California Coastal ESU (Redwood Creek and south) was listed as threatened in 1999 (USDC 1999a).

Chinook typically return from the ocean to rivers, larger streams, and larger tributaries to spawn between November and early January after three to four years in the ocean, although two year old male spawners are commonly observed. Winter-run chinook constitute the main chinook runs in RNSP streams. These fish begin their upstream migration around November, if access through the Redwood Creek estuary is possible, and have spawned and died by the end of January. Adult spring-run chinook were observed in only one season since 1981, when the park began Summer steelhead surveys, but are not typically

considered to use the Redwood Creek watershed. Chinook salmon spawning in the RNSP tributaries may be impeded by stream barriers, but they may be able to surmount some barriers that may impede the smaller coho salmon. Copper Creek is a steep, minor tributary to Redwood Creek and no chinook have been detected within Copper Creek during presence/absence surveys conducted at the mouth of the creek (RNSP unpub. data).

Juvenile chinook salmon in the Redwood Creek and Prairie Creek watersheds do not spend time rearing in upstream areas (Anderson and Brown 1982), but instead, utilize the Redwood Creek estuary. In spring, chinook salmon fry migrate downstream to rear in the estuary before entering the ocean in the fall. Thus, the Redwood Creek estuary is important as the sole rearing habitat for this ESU in the park. Research shows that if given the opportunity the juveniles will spend an extended period (to late summer) in the estuary before entering the ocean. Reimers (1973) documented the role estuaries play in fall chinook salmon production. From scale analysis of spawning fall chinook from the Sixes River, Oregon, he determined that the majority of returning adults spent June, July, and August as juveniles within the estuary before completing their seaward migration. His investigations determined that juvenile chinook spending less than three months in the estuary seldom returned to spawn in the natal stream. He concluded that these fish did not survive as well in the ocean as the fish that had spent three months in the estuary. Apparently a survival advantage was conferred upon the fish that remained in the estuary and grew to a larger size before entering the ocean.

B. Habitat Status

Chinook salmon rearing habitat was degraded when flood control levees that bisect the Redwood Creek estuary were constructed in 1968. The levees altered the physical and biological functions of the estuary and adjacent wetlands and confined the stream channel to a width of 300 ft. The flood control project reduced the amount of riparian vegetation and tree cover, reduced adjacent wetlands, altered valley drainage patterns, decreased the amount of instream woody debris, and caused decreased pool depths along lower Redwood Creek. The levees bypassed and isolated the last downstream meander of Redwood Creek, reduced circulation into the north and south sloughs, and contributed to 50% of the lower estuary between zero and four feet Mean Sea Level filling with sediment or becoming isolated from the embayment (Ricks 1983). Adjacent land uses, e.g., cattle grazing on the flood plain and uncontrolled breaching of the sand berm (which forms a barrier to the ocean across the mouth), also have contributed to habitat degradation of the estuary.

Critical habitat for California Coastal ESU chinook salmon was re-designated effective January 2, 2006. Potentially suitable habitat for this ESU in RNSP occurs in the Redwood Creek basin and includes all stream and estuarine reaches accessible to the species. Accessible reaches are those within the historical range of the ESU that can still be occupied by any life stage of the species.

Chinook Critical Habitat

Critical habitat is defined in Section 3(5)A of the Endangered Species Act as "...the specific areas within the geographical area occupied by the species... on which are found those physical or biological features (a) essential to the conservation of the species and (b) which may require special management considerations or protection". In designating critical habitat NOAA Fisheries considers habitat elements and conditions required for all life stages of the species. In addition, NOAA Fisheries also focuses on the known physical and biological features (primary constituent elements) within the designated area that are

essential to the conservation of the species. These essential features may include, but are not limited to, spawning sites, food resources, water quality and quantity, and riparian vegetation.

In California Coastal, NOAA Fisheries has designated critical habitat for this ESU to include all naturally spawned populations of chinook salmon from rivers and streams south of the Klamath River to the Russian River, California, as well as seven artificial propagation programs: the Humboldt Fish Action Council (Freshwater Creek), Yager Creek, Redwood Creek, Hollow Tree, Van Arsdale Fish Station, Mattole Salmon Group, and Mad River Hatchery fall-run chinook hatchery programs.

No chinook have been detected in Copper Creek and so is not considered critical habitat, however, Redwood Creek, the stream that Copper Creek is a tributary of, is occupied by chinook salmon and it and its associated riparian habitat are critical habitat.

2. Northern California Steelhead (*Oncorhynchus mykiss*), Threatened

A. Species Account

Steelhead trout were distributed historically throughout the North Pacific Ocean from the Kamchatka Peninsula in Asia to the northern Baja peninsula. Presently, the distribution extends from the Kamchatka Peninsula, east and south along the Pacific Coast of North America, to at least Malibu Creek in southern California. Steelhead likely inhabited most coastal streams in Washington, Oregon and California as well as many inland streams in these states and Idaho.

During this century, over 23 naturally reproducing stocks of steelhead are believed to have been extirpated, and many more are thought to be in decline in numerous coastal and inland streams in Washington, Oregon, California, and Idaho. Forty-three stocks have been identified as being at moderate or high risk of extinction. For these reasons, steelhead were listed as endangered in two environmentally significant units (DPSs) and threatened in four DPSs. The Northern California DPSs, from Redwood Creek south, falls within the boundaries of RNSP; it was listed as threatened on June 7, 2000.

Steelhead trout are found in most small order, high gradient tributaries to Redwood Creek. They are able to leap above barriers that might impede coho salmon (D. Anderson personal communication). Whether logjams are barriers to movement depends upon stream dynamics such as the size of the logjam and the stream discharge as well as the timing and duration of the steelhead migration. These events change from year to year.

Steelhead spawners are the last of the anadromous salmonid species to return to freshwater in the annual cycle, generally between January and April. Juveniles rear in the streams for one to four years before their downstream migration to the ocean. The majority of juvenile steelhead in Redwood Creek spend their second year of life in the estuary and lower part of Redwood Creek (Anderson 1988). They reside in marine waters typically for two or three years prior to returning to the natal stream to spawn. Unlike other Pacific salmon, steelhead trout are capable of spawning more than once before they die.

Summer steelhead surveys began in the park in 1981 and survey data have indicated a continuous decline since that time. Forty-four is the highest total number of adult fish observed during summer surveys of portions of the mainstem of Redwood Creek. No adult fish were seen in 1989 or 2001. The number of adult steelhead counted in 2005 was 22, in 2004 eight adults were counted. No other park streams in the

Redwood Creek basin have been surveyed for summer steelhead; the smaller streams do not have pools large enough to support fish during the warm summer months.

Winter-run steelhead numbers are higher than summer steelhead numbers. Juvenile winter-run steelhead are the most common and widely distributed fish in the Redwood Creek basin. During sampling efforts in the summers of 1980 and 1981, steelhead trout occurred in 57 of the 111 tributaries surveyed (Anderson 1988, Brown 1988). In recent years winter stream surveys have been conducted along the mainstem of Redwood Creek (flows permitting), Lost Man Creek, Little Lost Man Creek, Prairie Creek, Mill Creek, and Bridge Creek (Holden 2002). Steelhead have been detected in Copper Creek near the mouth but are unlikely to occur much farther up the creek due to the steepness of the watershed (Anderson 1988, Anderson pers. comm.).

B. Habitat Status

Steelhead habitat requirements change as they go through different life phases. Adult steelhead need to have access to their natal streams, therefore, it is important that streams are free of barriers to migration, as the majority of spawning occurs in the upper reaches of tributaries. Adults also need access to spawning gravel in areas free of heavy sedimentation with adequate flow and cool, clear water. Steelhead utilize gravel that is 0.5-6 inches in diameter, dominated by 2 to 3 inch gravel. Escape cover for spawning adults also is important.

Steelhead eggs and pre-emergent fry require cool water with adequate dissolved oxygen. Fine sediment smothers developing eggs, so the area must be free of silt and the water clear. During their first summer, juvenile steelhead are typically found in relatively shallow areas with cobble and boulder bottoms. They reside at the downstream end of shallow places or in riffles less than two feet deep in areas with woody debris accumulation (logs or tree roots). Cover structures such as boulder clusters and root wads provide both summer and winter rearing habitat. Surface turbulence (or white water) provides another source of cover during the summer months. As juvenile steelhead grow, pools become an important habitat component. The best pools for habitat are those with abundant escape cover in the form of large woody debris, undercut banks, root masses, and large boulders.

Many of the small order, high gradient tributaries to Redwood Creek provide suitable habitat for steelhead in RNSP, including the very lowest reach of Copper Creek. Copper Creek's lowest reach has good riparian cover which keeps the water temperature low, and a small amount of riffles with a variety of gravel sizes, a few small pools for rearing, and instream cover provided by boulders and bedrock that provides protection for both adult and juvenile fish. There is no LWD (pers. obs.) because the whole watershed was clearcut in the early 1970's. Critical habitat for Northern California DPS steelhead trout was designated effective January 2, 2006. Potentially suitable habitat for this DPS in RNSP occurs in the Redwood Creek basin and includes all stream and estuarine reaches accessible to the species. Accessible reaches are those within the historical range of the DPS that can still be occupied by any life stage of the species.

Steelhead Critical Habitat

Critical habitat is defined in Section 3(5)A of the Endangered Species Act as "...the specific areas within the geographical area occupied by the species... on which are found those physical or biological features (a) essential to the conservation of the species and (b) which may require special management considerations or protection". In designating critical habitat NOAA Fisheries considers habitat elements and conditions required for all life stages of the species. In addition, NOAA Fisheries also focuses on the

known physical and biological features (primary constituent elements) within the designated area that are essential to the conservation of the species. These essential features may include, but are not limited to, spawning sites, food resources, water quality and quantity, and riparian vegetation. NOAA Fisheries designated critical habitat for this DPS between Redwood Creek, California and Russian River, California.

3. Southern Oregon/Northern California Salmon (*Oncorhynchus kisutch*), Threatened

A. Species Account

Coho or “silver” salmon are found in streams and rivers throughout much of the Pacific Rim, from central California to Korea and northern Japan. Coho are anadromous and have a life history similar to chinook. However, the time they spend in fresh and salt water is relatively fixed, compared to the more variable life history of chinook. North of central British Columbia, coho tend to spend two years in freshwater, while south of this point they spend only one year in the freshwater. Unlike chinook, where most production comes from mainstem spawning areas, coho tend to use smaller streams and tributaries. North American coho spawn in tributaries from the San Lorenzo River in Monterey Bay, California to Point Hope, Alaska, and throughout the Aleutian Islands. They are most abundant in coastal areas from central Oregon to southeast Alaska.

Coho salmon have shown substantial decreases throughout their range (Konkel and McIntyre 1987). In the U.S. Pacific Northwest, they are now extinct in the eastern half of their former range, and badly depleted over most of the western half (Frissell 1993). At least 33 populations have been identified by agencies and conservation groups for being at moderate or high risk of extinction. Overall a geographic trend for west coast coho salmon stocks has developed with the southernmost and easternmost stocks in the worst condition. In California, including hatchery stocks, current abundance could be less than 6% of estimates for the period 1940 to 1949. Populations now are at least 70% lower than during the 1960s (CDFG 1994). The Southern Oregon/Northern California Coasts ESU for coho salmon, where RNSP is located, were designated as threatened in 1997 (USDI 1997).

The anadromous fish populations of Redwood Creek have experienced a substantial reduction during the last 30 years, in part due to severe flood events that moved large amounts of sediment from highly eroded hill slopes to the stream channels of the Redwood Creek basin. Current fish runs are far below those that occurred 70-80 years ago. News accounts and recollections of longtime residents of the Redwood Creek watershed suggest that both the size and numbers of salmonids have declined in recent decades (Van Kirk 1994). The total population in the Redwood Creek system may have numbered more than 2,000 adult coho; most occurred in the Prairie Creek drainage and probably originated from the Prairie Creek Hatchery (D. Anderson field notes). Since the closure of the hatchery in 1992 the number of coho are probably much lower.

After hatching juvenile coho salmon generally spend one full year rearing in freshwater before entering the ocean. However, Bell (2001) determined a two-year freshwater life history component, 28%, in Prairie Creek smolts. Downstream migration of coho to the ocean from upstream Redwood Creek rearing areas occurs in early spring (March-April). Survey data from RNSP indicate that these young salmon move directly into the ocean, spending a minimal amount of time in the Redwood Creek estuary (Anderson 1995). Migration through the Redwood Creek estuary is dependent upon the mouth being open to the ocean. Adult coho typically run upstream to spawn from late October to early March depending on access through the estuary (Anderson 1995). The conditions at the mouth depend on a

combination of wave action on the sand berm, the volume of water in the estuary, and the flow of water in the stream.

Coho salmon distribution in the Redwood Creek basin is limited to the mainstem and the larger low gradient tributaries. The park conducted general stream surveys of the basin in 1980 and 1981 to describe and characterize the salmonid rearing habitat and distribution of juvenile salmonids (Anderson 1988, Brown 1988). Migrational barriers were identified during those electrosurveys; no coho were found above the barriers. However, subsequent surveys in the 1990s have detected coho in streams that did not have coho in 1980-81.

B. Habitat Status

Based on data collected by RNSP fishery biologists, it was estimated that coho can be found occupying 26 miles of stream within the Lower Redwood Creek Basin. Coho have not been found in Copper Creek but are in Redwood Creek, at least transitionally, where Copper Creek empties into Redwood Creek (RNSP unpub. data).

Critical habitat is defined in Section 3(5)A of the Endangered Species Act as "...the specific areas within the geographical area occupied by the species... on which are found those physical or biological features (a) essential to the conservation of the species and (b) which may require special management considerations or protection". In designating critical habitat NOAA Fisheries considers habitat elements and conditions required for all life stages of the species. In addition, NOAA Fisheries also focuses on the known physical and biological features (primary constituent elements) within the designated area that are essential to the conservation of the species. These essential features may include, but are not limited to, spawning sites, food resources, water quality and quantity, and riparian vegetation. Structurally complex streams containing stones, logs, brush, and aquatic macrophytes support larger numbers of rearing coho juveniles (Scrivener and Andersen 1982) than do streams that lack these structural features.

In southern Oregon and northern California, NOAA Fisheries has designated critical habitat for this ESU between Cape Blanco, Oregon and Punta Gorda, California. The critical habitat unit is all stream and estuarine reaches accessible to the species and includes water, substrate, and the adjacent riparian zone. Accessible reaches are those within the historical range of the ESU that can still be occupied by any life stage of coho. The adjacent riparian zone is the area that provides shade, sediment transport, nutrient or chemical regulation, streambank stability, and input of large woody debris or organic matter. Habitat quality in this zone is related to the quality of riparian areas, upland areas, and inaccessible or headwater or intermittent streams that provide key habitat elements, such as large woody debris and gravel, that are crucial for coho in downstream reaches (USDC 1999b). Thus, the width of the riparian zone included as critical habitat is variable depending upon consideration of these factors. Based on this definition, Copper Creek is not critical habitat but Redwood Creek is.

4. Environmental Baseline

a. Redwood Creek Watershed Baseline

Detailed watershed baseline condition descriptions for Redwood Creek can be found in the recently completed Annual Routine and non-routine road maintenance program in Redwood National and State Parks biological assessment (RNSP 2002a), the Redwood Creek Watershed Analysis (RNSP 2002b), and

the Total Maximum Daily Load for Sediment: Redwood Creek, California (EPA 1998). All of these documents are on file at RNSP and the NOAA Fisheries office in Arcata, California.

The upper third of the Copper Creek watershed is composed of grassland and oak woodland while the lower two thirds is composed of approximately 35 year old second growth conifer forest. The entire conifer forest portion of the watershed was clearcut in the early to mid 1970's before being acquired by the National Park Service. It was crisscrossed by logging roads used to haul the timber downhill to the K&K main haul road. All of the roads within the watershed were removed in the late 1970's and early 1980's after the land was incorporated into Redwood National Park. Approximately the lower third of Copper Creek is perennial with direct connection to Redwood Creek being disrupted in the late fall dry season.

b. Smith River Watershed Baseline

Detailed watershed baseline condition descriptions for the entire Smith River can be found in Smith River Watershed Analysis (Smith River National Recreation Area 1995). Detailed watershed baseline condition descriptions for just Mill Creek can be found in the Mill Creek Property, Interim Management Recommendations (Stillwater Sciences 2002). Both of these documents are on file at RNSP and the NOAA Fisheries office in Arcata, California.

VI. IMPACTS TO THREATENED AND ENDANGERED SPECIES

A. Direct Effects

California Coastal (CC) Chinook Salmon, Southern Oregon/Northern California Coasts (SONCC) Coho Salmon, and Northern California (NC) Steelhead Trout and Critical Habitat

A. 2010 Redwood National Park Fire Management Plan

1) Prescribed Burning in Prairies (Grasslands), Oak Woodlands, Pine Woodlands, Coastal Scrub and Second Growth Coniferous Forest

Burning the following prescribed burn units will have no effect on listed salmonids because they are not located in anadromous watersheds: DeMartin, Enderts, Lagoon Creek and Major Creek (Table 1).

Burning the following prescribed burn units will have no effect on listed salmonids because no perennial streams are within 300 feet of the burn unit and no intermittent streams are within 100 feet of the burn unit: Airstrip Upper, Dolason Lower, Dolason Upper, Eastside, Elk Camp, Gans Lower, Gans Upper, Holter Ridge Beargrass, Lyons Upper, Maneze, School House, Tick, Upper K&K, Williams Ridge, Wooden Gate (Table 1). These units are all located at or near ridgetops. Intervening unburned vegetation and downed woody material will prevent any ash from being transported into any stream course.

Potential negligible effects could result if intermittent streams within 100 feet of burn units or sheet flow into perennial stream within 300 feet of burn units carry ash sediment downstream into occupied fish bearing streams from the following burn units: Airstrip Lower, C-10, Child's Hill, Copper Creek, Counts Upper, Counts Lower, Coyote Creek, Davison, Dooleyville, Elk Camp Lower, Little Bald Hills, Lower Lyons, Mainstem, Mid Basin, and South Boundary (Table 1). Even this scenario is unlikely, however, because only very small amounts of biomass will be burned in these burn units (i.e. only the top stalks of

grass will be burned leaving leaf bases and root stalks intact). Vegetative recovery within these vegetation types of burn units is rapid and occurs within one season (Leonel Arguello, pers. comm.). In addition, past informal monitoring efforts of intermittent streams in or adjacent to these proposed burn units have indicated none to negligible amounts of ash transport or sedimentation after prescribed burning (Vicki Ozaki, pers. comm.; Barry Hill, letters on file). Measurable amounts of ash sediment, therefore, is not expected to originate from most of the prescribed prairie, oak woodland, pine woodland, coastal scrub and second growth coniferous forest burn units. It should be noted that the Copper Creek prescribed burn unit is within the same watershed as the Wildcat burn unit but is located at the top of the watershed and is of a different vegetation type (grass and oak woodland) than the lower down located Wildcat unit (second growth conifer). The Copper Creek unit will be affected differently by prescribed burning due to the much lower biomass that will be consumed by fire and its farther distance from the perennial stream flow areas as compared to the Wildcat unit.

Another potential sediment source caused by proposed activities is hand line construction whereby bare soil is exposed. Hand lines, however, will not cause sedimentation because they will be rehabilitated immediately after prescribed burning. Most of the fire lines will be mowed grass, wet lines, or utilize forest edges which do not expose any bare soil.

No contamination from retardant use should occur because only buildings will be treated, all of which are located more than 300 feet from any intermittent or perennial stream.

The only time and place where a measureable amount of ash sediment may wash into fish bearing streams would be during initial rains occurring immediately after prescribed burns in units within 150 feet of perennial streams. Two units are within 150 feet of perennial streams (Pig Pen and Wildcat – Table 1, Appendix 2, Map 2).

The Pig Pen prescribed burn unit is located within 150 feet of anadromous fish bearing Redwood Creek. The unit is small (69 acres) and a 50 foot wide strip of riparian shrubs and red alders exist between the unit and Redwood Creek. Prescribed burns within this unit have historically been very spotty with significant portions of the unit not igniting due to the high fuel moistures and significant shading caused by the surrounding old growth redwood forest (Leonel Arguello pers. comm.). In addition, this unit is composed entirely of grass and small shrubs that results in a small amount of biomass that will actually burn. And, like other grassland sites, the vegetation will rapidly regrow (i.e. within the first few weeks after initial rains), rapidly increasing site stability and further preventing ash transportation. Due to these compounding negating factors, it is expected that a negligible to only a very small amount of ash would enter Redwood Creek, even with its close proximity to the unit. This minor adverse effect would be short lived; primarily right after the first major rainstorm of the first post burn season, which should be approximately in November or December. The life stages present at that time of the year in Redwood Creek near the Pig Pen unit would be adult migrating chinook and coho salmon and rearing juvenile coho and steelhead trout. Due to the high volume of water flowing through Redwood Creek at that time of year, any ash sediment that does reach the stream should be rapidly diluted and so any adverse effects (mainly turbidity, gill irritation and possibly a slight change in water acidity) should be very localized to immediately adjacent to the unit. The localized adverse effect should rapidly dissipate over a matter of days if not hours.

The Wildcat unit is entirely composed of second growth coniferous forest. The burn prescription is for a “cool” under burn that will only consume small diameter woody ground fuels, small pole sized trees, herbaceous vegetation, and duff. The forest canopy should not change significantly from its existing level of almost 100% (see Appendix 3 for results of past prescribed burning within another RNSP second growth conifer forest unit). Copper Creek runs through the middle of the unit. Riparian shading will not change post burn, as the forest canopy will not alter significantly. The intact forest canopy will also

greatly lessen the impact force of falling rain which should decrease the amount of mobilized ash sediment. The majority of the ash sediment that is transported should be prevented from entering the stream by the remaining larger woody debris that will not be consumed by the fire. In addition, the fire is expected to be spotty (R. Young pers. comm.), with many unburned areas remaining, which should act as ash sediment traps. In particular, it is likely that the damper riparian areas near the perennial sections of the stream will not burn at all due to high fuel moisture content (R. Young pers. comm.). These unburned riparian areas will also act as ash sediment traps. Some ash sediment, however, may reach the stream. This minor adverse effect would be short lived; primarily right after the first major rainstorm of the first post burn season, which should be approximately in November or December. The listed salmonid life stages present in Copper Creek at that time of year will be rearing juvenile steelhead trout and in Redwood Creek there would be adult migrating chinook and coho salmon and rearing juvenile coho and steelhead trout. Due to the high volume of water flowing through Redwood Creek at that time of year, any ash sediment that does reach the stream should be rapidly diluted and so any adverse effects (mainly turbidity, gill irritation and possibly a slight change in water acidity) should be very localized to immediately adjacent to the unit. The localized adverse effect should rapidly dissipate over a matter of days. A stream quality monitoring program will help assess the actual impact of the prescribed burn.

3) Shaded Fuel Breaks

None of the five shaded fuel breaks are within 300 feet of any perennial stream and thus the thinning prescription for these fuel breaks will have no effect on listed salmonids or their habitat.

4) Historic Structure Annual Hazard Fuel Reduction

None of the seven historic structures is within 300 feet of any perennial stream and thus the grass mowing around each building will have no effect on listed salmonids.

5) Pond Maintenance

The grass mowing and brush clearing around the four water source ponds will have no effect on listed salmonids because the ponds are located near ridge tops, well up slope from any anadromous reaches of any streams.

6) Holding Tank Placement

The four holding tanks will all be located at least 300 feet from any perennial stream and will be filled by rainwater and so they will have no effect on listed salmonids.

B. California Department of Parks and Recreation Prescribed Burning

1) Old Growth Forest Units

The two old growth prescribed burn units are both more than 300 feet from any perennial stream and there are no intermittent streams within 100 feet of either unit. Also, both units are located on flat ground and so there is no possibility for ash sediment transport to any stream. Therefore, there is no possibility for the burning of either unit to effect listed salmonids.

2) *Coastal Scrub Unit*

The Ossagon prescribed burn unit is not located in a watershed containing anadromous fish and so there will be no effect to listed salmonids.

3) *Coastal Grassland Unit*

The 166 acre Boyes Prairie grassland burn unit is located on flat ground at least 300 feet from any intermittent or perennial stream and so there is no possibility for effects to listed salmonids.

B. Indirect Effects

No indirect effects are expected from any component of the proposed action.

C. Cumulative Effects

Cumulative effects are those state and private actions that may occur in the future that have the potential to impact listed species in the park. Much private timber company land occurs immediately adjacent to park boundaries, some of it scheduled for pre-commercial thinning and/or post - timber harvest prescribed burning in preparation for reforestation. Thinning and prescribed burning has occurred extensively in harvested stands adjacent to the park (Greg Bundros pers. comm.). Prescribed burning associated with timber harvest plans adjacent to RNSP is not likely to add to any measurable impacts identified in the effects analyses for this proposed action. Thinning that will occur throughout the surrounding private timber lands will most likely be using prescriptions which remove much more basal area and open up the canopy more than those being proposed in this plan. The thinning will most likely cause some temporary habitat degradation to some listed salmonid habitat. The use of riparian management zones as stipulated in the California Forest Practice Rules and Habitat Conservation Plans should provide some significant protection of streamside areas.

VII. DETERMINATION

Based on the nature and timing of the proposed actions, it is my determination that the 2010 Fire Management Plan may affect and is likely to adversely affect California coastal chinook salmon, northern California steelhead trout or southern Oregon/northern California coastal coho salmon and their critical habitat due to minor amounts of short term ash sedimentation caused by prescribed burning of the Wildcat and Pig Pen burn units. An unknown and unquantifiable, but presumed small number of individual fish will be affected.

VIII. MANAGEMENT RECOMMENDATIONS

There are no management recommendations beyond the conservation measures already built into the proposed action.

VIX. CONTRIBUTORS

Rick Young, Proposed Action Review
Jay Harris, Proposed Action Review
Judy Wartella, Map Production

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Appendix 1

Guidelines to Reduce or Eliminate Impacts to Threatened and Endangered Species and Non Listed Fish and Wildlife Species During Wildfire or Escaped Prescribed Fire Suppression Efforts

***PLEASE NOTE!**

Never allow these fire suppression guidelines to obstruct any actions when human lives are at stake. Never utilize these guidelines if by their use human safety could be compromised. In addition, the potential risk to property or significant resources may also preclude the implementation of any or all of these fire suppression guidelines.

Emergency Consultation with USFWS and NOAA Fisheries - The RNSP Fish and Wildlife Branch will initiate emergency consultation with both regulatory agencies within at least 48 hours, preferably within 24 hours, of initial attack on any wildfire or escaped prescribed fire. The assigned RNSP biologist(s) will work with the incident command team both during and after the incident on gathering pertinent information necessary for the consultation.

I. Terrestrial Species Protection Measures

1) General Guidelines -

- A wildlife biologist or fish and wildlife biologist (preferably one with local knowledge) should serve as a resource advisor with the incident command team (ICT). The biologist(s) will coordinate with the ICT about listed terrestrial species and their critical habitat and incorporate recommendations within the Incident Action Plan to minimize adverse effects.
- If a wildlife biologist or fish and wildlife biologist is not available, assure that someone with local wildlife knowledge provides the ICT with information about the location of listed species habitats, nest or den sites, critical habitat, and recommendations to minimize adverse effects summarized below.

2) Aircraft Flight Guidelines -

***PLEASE NOTE!**

These guidelines are for aircraft flying over RNSP lands away from any active wildfire location and are not intended to influence approach or exit flight lines during aerial water/retardant drops or low elevation reconnaissance of fire activity. At no time should the helicopter or airtanker pilot-in-command fly in such a way as to endanger the aircraft, other aircraft, or structures, or compromise ground personnel safety in order to implement these guidelines.

- Please refer to further guidelines concerning aerial retardant drops near lakes, streams, rivers and ponds in the Anadromous and Other Aquatic Species Protection Measures section below.

- When flying over forested regions of RNSP between January 1st and September 15th, restrict flight elevations to at least 500 feet, preferably 1000 feet, above the canopy of suitable marbled murrelet and spotted owl habitat.
- When flying over known active spotted owl nests between February 1st and July 9th, restrict flight elevations to at least 1000 feet above the canopy within 0.25 miles of the nest site. Consult with the assigned ICT biologist for information on known active owl nest locations.
- When flying over known active bald nests between January 1st and August 31st, restrict flight elevations to at least 500 feet above the canopy within 0.5 miles of the nest site. Consult with the assigned ICT biologist for information on known active eagle nest locations.
- When flying over the Steller's sea lion colony during any time of the year, restrict flight elevations to at least 1000 feet above sea level with 0.25 miles of the colony.
- When flying over ocean beaches and offshore rocks between March 1st and September 30th, restrict flight elevations to at least 500 feet, preferably 1000 feet, above sea level. If the aircraft appears to cause seabirds or marine mammals to flush, gain elevation by at least 500 feet during future passes.
- When flying within 1000 feet of known active peregrine falcon eyries, restrict flight elevations to at least 500 feet. Consult with the assigned ICT biologist for information on known active peregrine falcon eyrie locations.

3) Direct Attack, Fire Line Construction and Mop Up Guidelines –

- When fire is found in the canopy of single or multiple isolated large (>36 inch DBH) old growth trees, it is always preferable to extinguish the fire with a “bucket drop” from a helicopter and to avoid, if at all possible, felling the tree or letting it continue to burn.

- Where possible, expedient and fire fighter safety will not be compromised or fire suppression activities significantly hindered, avoid felling trees larger than 18 inches DBH when constructing fire lines, particularly trees with broken or deformed tops.
- Where possible, expedient and fire fighter safety will not be compromised or fire suppression activities significantly hindered, avoid felling snags greater than 24 inches DBH.
- Avoid placing fire camps 0.25 miles and heliports within 0.5 miles of suitable spotted owl and marbled murrelet habitat between February 1st and September 15th. This period would extend to January 1st near known bald eagle nest sites. Where possible, expedient and where fire fighter safety will not be compromised or fire fighting suppression activities significantly hindered, avoid placing spike camps and staging areas within 0.25 miles of suitable spotted owl and marbled murrelet habitat between February 1st and September 15th. This period would extend to January 1st near known bald eagle nest sites. Consult with the assigned ICT biologist for information on known active eagle nest locations.
- Inform all fire fighting field staff to always pack out all food waste and to never feed any wildlife.

II. Anadromous Fish and Other Aquatic Species Protection Measures

1) General Guidelines -

- A fishery biologist or fish and wildlife biologist (preferably one with local knowledge) should serve as a resource advisor with the incident command team (ICT). The biologist(s) should coordinate with the ICT about listed salmon and trout and their critical habitat and incorporate recommendations within the Incident Action Plan to minimize adverse effects.
- If a fishery biologist or fish and wildlife biologist is not available, assure that someone with local fisheries knowledge provides the ICT with information about the location of listed salmon and trout, their critical habitat, and recommendations to minimize adverse effects listed below.
- Use untreated water to suppress wildland fire within or near riparian habitat where feasible. If fire retardant or foam is used, follow the Guidelines for Aerial Delivery of Retardant or Foam Near Lakes, Rivers, Streams and Ponds detailed below.
- Avoid or minimize disturbance of ground cover and vegetation that exposes mineral soil within riparian areas, including:
 - fire line construction by dozers;
 - grading activities;
 - road reconstruction;
 - stream crossings;
 - ignition of backfires; and
 - staging areas, helibases, base camps, drop-off points, etc.

- Use water sources designated by a biologist for dipping and drafting. If not available, minimize using water sources where there is a risk of entraining listed salmon or trout or reducing in-stream flows, both on and off site. Use Water Drafting Guidelines detailed below.
- Avoid and minimize dam construction to pond water for drafting in streams where listed salmonids or their critical habitat are known or believed to be present.
- Avoid and minimize road and stream crossing construction where possible. If road construction is unavoidable, do so in a manner that prevents or minimizes erosion, sediment delivery to stream channels, and modification of the natural drainage patterns. Minimize the number of crossings, amount of fill, diversion potential, and maintain approaches that are perpendicular to the stream channel.

2) Guidelines for Drafting Water from Streams Containing Federally Listed Salmon and Trout

- Drafting will be restricted to one hour after sunrise to one hour before sunset to avoid attracting fish to the draft hose.
- Pumping rate will not exceed 350 gallons per minute.
- Pumping rate will not exceed 10% of estimated stream flow.
- Use streams and pools where water is deep and flowing, as opposed to streams with low flow and small isolated pools.
- Pumping will be terminated when the tank is full. The effect of single pumping operations, or multiple pumping operations at the same location, should not result in obvious draw-down of either upstream or downstream pools.
- Each pumping operation will use a fish screen (design standards described below). The screen should be oriented parallel to flow for best screening performance. The screen will be designed and used so that it can be submerged with at least one-screen-height-clearance above and below the screen.
- Pump operators will maintain a logbook containing the following information: operator's name, date, time, pump rate, filling time, screen cleaned (yes or no), screen condition, comments. These guidelines should be included as instructions in the logbook and made easily available to every operator.

Fish Screen Construction Criteria

- **Surface Area** – The total, unobstructed surface area of the screen will be at least 2.5 square feet, based on the upper limit of pumping of 350 gallons per minute. Larger surface areas are recommended where debris buildup is anticipated and where stream depth is adequate to keep the screen submerged at approximately mid-depth.
- **Screen Mesh** – Screen mesh must be in good repair and present a sealed, positive barrier that effectively prevents the entry of immature (20-30mm) salmon or trout fry. The screen mesh will be: round openings a maximum 3/32 inch diameter, square openings a maximum 3/32 diagonal, slotted openings a maximum 1/16 inch width.
- **Screen Design** – Water drafting screens may be off the shelf products, but they can be custom made devices appropriate to the scale and duration of the operation. To keep the screen supported and correctly positioned in the water column, adjustable support legs are advised. Screen geometry can be configured either as rectangular or cylindrical. The intake structure must be designed to promote uniform velocity distribution at all external mesh surfaces. This can be accomplished with a simple internal baffle device that distributes the flow evenly across the entire surface of the screen. In order to accomplish this, the designer needs to understand the hydraulic characteristics of these devices. There is a tendency for most of the intake water to enter the screen near the hose end, so a typical internal baffle would consist of a pipe (or manifold set of pipes) which have variable porosity holes at predetermined spacing. It is recommended to start near the hose end with approximately 5-10% average open area and gradually increase the porosity toward the length of the screen. At a point where screen length exceeds three times the diameter of the suction hose, the baffling effect tends to diminish rapidly. At this point the baffle porosity may approach 100%. A successful baffle system will functionally distribute flow areas to all areas of the screen. A poorly designed screen may result in high velocity “hot spots” which could lead to fish impingement on the screen face. Hydraulic testing of prototype screen designs is recommended where the screen use is on going and extensive.
- **Screen Structure** – The screen frame must be strong enough to withstand the hydraulic forces it will experience. However, structural frames, braces, and other elements that block the flow, change flow direction, or otherwise decrease the screen surface area should be minimized.
- **Screen Cleaning** – The screen must be cleaned as often as necessary to prevent approach velocity from exceeding 0.33 feet per second. Operators should withdraw the screen and clean it after each use or as necessary to keep screen face free of debris. Pumping should stop for screen cleaning when approximately 15% or more of the screen area is occluded by debris. A suitable brush shall be on board the truck for this cleaning operation.

3) Guidelines for Aerial Delivery of Retardant or Foam Near Lakes, Rivers, Streams and Ponds -

***PLEASE NOTE!**

At no time should the helicopter or airtanker pilot-in-command fly in such a way as to endanger the aircraft, other aircraft, or structures, or compromise ground personnel safety in order to implement these

guidelines. Deviations from these guidelines are acceptable when life or property is threatened and the use of retardant or foam can be reasonably expected to alleviate the threat.

- Avoid aerial application of retardant or foam within 300 feet of waterways. To meet the 300-foot buffer zone guideline, implement the following:
- Airtankers: When approaching a waterway visible to the pilot, the pilot should terminate the application of retardant approximately 300 feet before reaching the waterway. When flying over a waterway, pilots should wait one second after crossing the far bank or shore of a waterway before applying retardant. Pilots should make adjustments for airspeed and ambient conditions such as wind to avoid the application of retardant within the 300-foot buffer zone.
- Helicopters: When approaching a waterway visible to the pilot, the pilot should terminate the application of retardant or foams 300 feet before reaching the waterway. When flying over a waterway, pilots should wait five seconds after crossing the far bank or shore before applying the retardant or foam. Pilots should make adjustments for airspeed and ambient conditions such as wind to avoid the application of retardant or foam within the 300-foot buffer zone.
- When alternative line construction tactics are not available due to terrain constraints, congested area, life and property concerns, or lack of ground personnel, it is acceptable to anchor the foam or retardant application to the waterway. When anchoring a retardant or foam line to a waterway, use the most accurate method of delivery in order to minimize placement of retardant or foam in the waterway (e.g., a helicopter rather than a heavy airtanker).
- When potential damage to natural resources outweighs possible loss of aquatic life, the unit administrator may approve a deviation from these guidelines.

4) Guidelines for Wildland Fire Rehabilitation Actions -

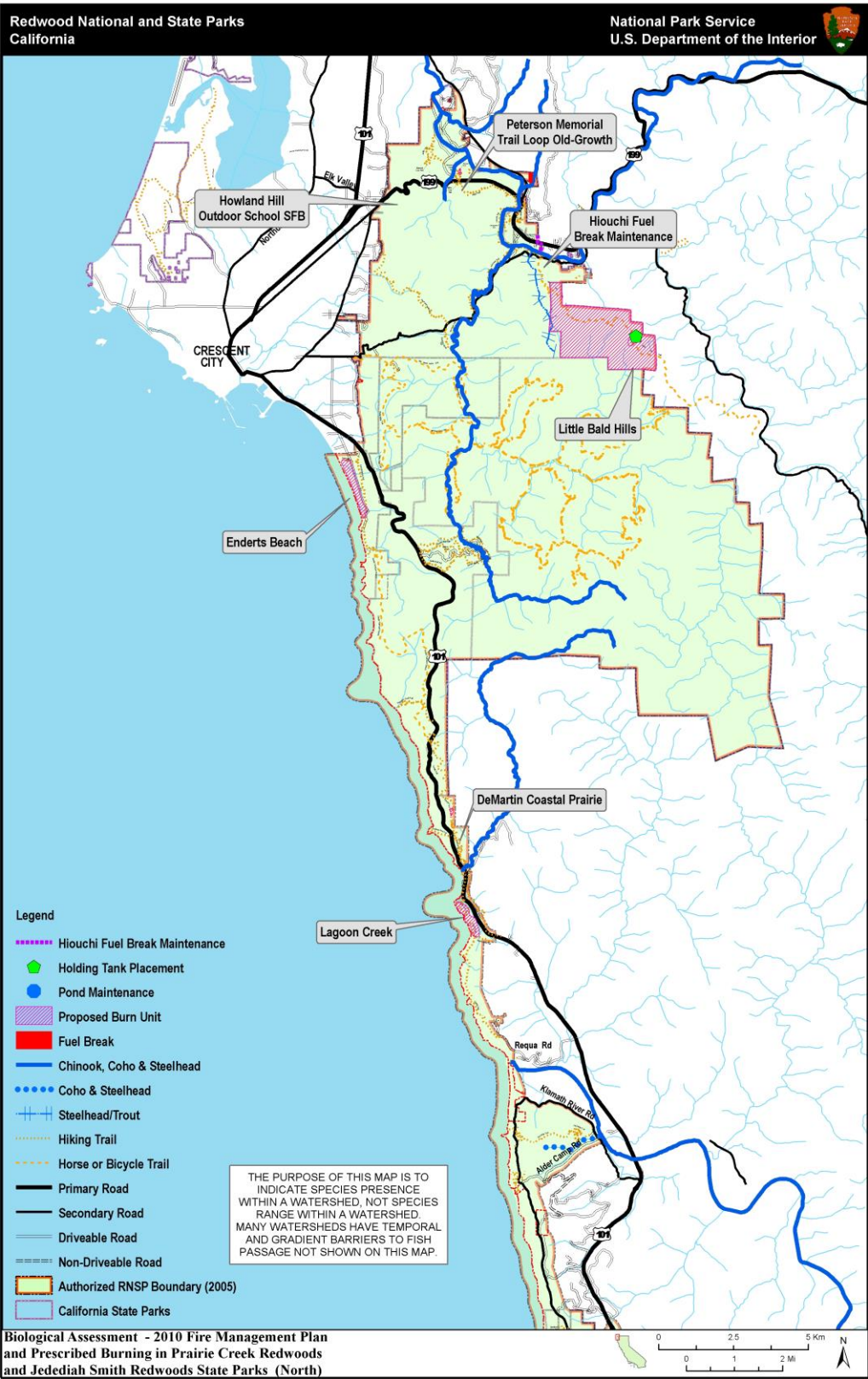
This section provides recommendations for avoiding and minimizing adverse effects on listed salmon and trout and their critical habitat from wildland fire rehabilitation activities. There are two types of emergency rehabilitation associated with wildland fires: fire suppression rehabilitation and burned area emergency rehabilitation (BAER). Fire suppression rehabilitation is any action that minimizes the effects of wildland fire suppression activities. BAER activities are implemented to reduce the effects of the wildland fire prior to the onset of winter precipitation.

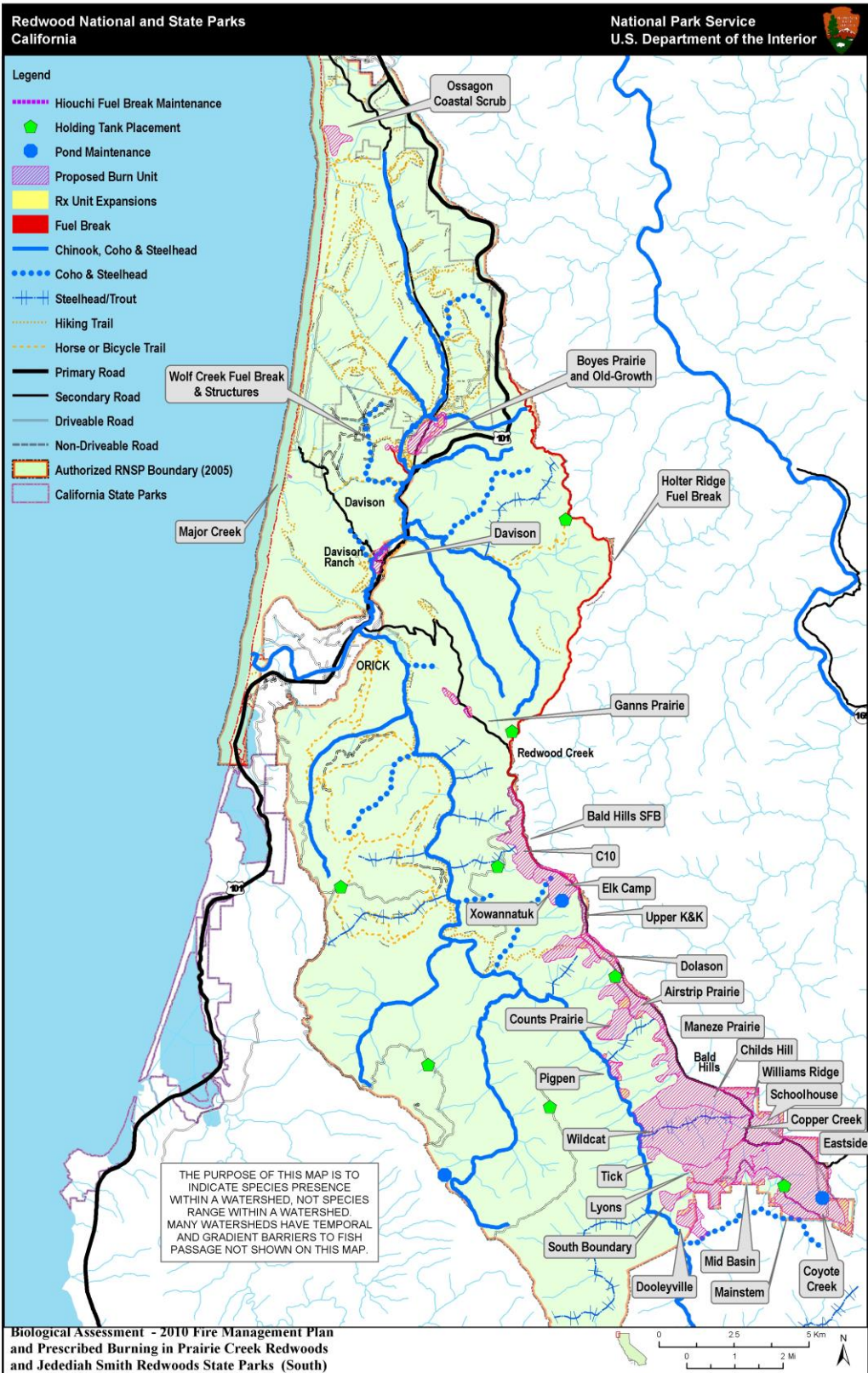
- Remove woody debris or slash from stream channels only if it may cause an imminent threat of damage to life or property (e.g., above a culvert inlet that could potentially plug).
- Implement erosion control measures to restore natural drainage patterns and minimize the amount of exposed mineral soil, thereby reducing sediment delivery to stream channels.
- Decommission roads and stream crossings constructed for fire suppression actions.
- Decommission dams at drafting sites developed for the Actions.

- Include a fisheries biologist with local knowledge on the wildland fire suppression rehabilitation and BAER teams for identifying activities that benefit listed salmonids and their critical habitat.

Appendix 2

Maps





Appendix 3

Large Tree Mortality Post Prescribed Fire Monitoring Results From DA Second Growth Unit

Note, the 30 acres DA Second Growth Prescribed Burn Unit was burned in the fall of 2007 using the same prescription that will be used on all second growth burn units under the 2010 Fire Management Plan.

Hi Keith,

Here is a summary of results from Jason's DA second growth plots. 21 plots were measured preburn (summer 2006) and one year postburn (summer 2008). For overstory trees > 20 cm (7.9") DBH, there was a 3.7% reduction in density, and a 2.1% reduction in basal area. The results are as follows:

Overstory (> 20 cm DBH) tree density (trees/ha)

Preburn: 577.4

1 year postburn: 556

Overstory (> 20 cm DBH) basal area (m²/ha)

Preburn: 67.9

1 year postburn: 66.5

Let me know if you need any additional information.

-Jen



**UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration**

NATIONAL MARINE FISHERIES SERVICE
Southwest Region
501 West Ocean Boulevard, Suite 4200
Long Beach, California 90802-4213

FEB 9 2010

In response refer to:
2009/04519

Mr. Steve W. Chaney
NPS Superintendent
Redwood National and State Parks
1111 Second Street
Crescent City, California 95531

Dear Mr. Chaney:

This letter transmits NOAA's National Marine Fisheries Service's (NMFS) final biological opinion (Enclosure 1) and Essential Fish Habitat (EFH) consultation (Enclosure 2) pertaining to the Redwood National and State Parks' (RNSP) Redwood National Park Fire Management Plan and Burning in Prairie Creek Redwoods and Jedediah Smith Redwoods State Parks (RNSP Plan). The enclosed biological opinion concludes formal consultation on the site-specific proposed actions associated with the RNSP Plan including prescribed burns, shaded fuel breaks, historic structure hazard fuel reduction, pond maintenance, and holding tank placement.

The Biological Assessment (BA) for the RNSP Plan included an appendix titled "Guidelines to Reduce or Eliminate Impacts to Threatened and Endangered Species and Non Listed Fish and Wildlife Species during Wildfire or Escaped Prescribed Fire Suppression Efforts" (Guidelines). Regarding the Guidelines, the BA states that:

These wildfire suppression guidelines are only guidelines, *not proposed actions*. The unpredictability of wildfires and the subsequent potential threats to human safety and significant resources could possibly dictate wildfire suppression tactics that would possibly overrule some or all of the recommendations in the guidelines. This unpredictability prevents any meaningful analysis from being conducted. *Any wildfire suppression tactics and activities, therefore, will be analyzed under emergency consultation procedures and will not be mentioned further in this document.*

BA at 3-4 (emphasis in original).

NMFS recognizes that threats to human safety and significant resources could possibly overrule some or all of the recommendations in the Guidelines. NMFS also understands that, due to their programmatic nature, the Guidelines are distinct from the site-specific proposed actions associated with the RNSP Plan. However, NMFS believes that relying solely on the emergency consultation procedures found at 50 CFR § 402.05 is inappropriate. Therefore, for the reasons discussed below, NMFS recommends that the National Park Service (NPS) initiate consultation on its use of the Guidelines pursuant to section 7(a)(2) of the Endangered Species Act and its implementing regulations.



A separate consultation on the NPS' use of the Guidelines is necessary for several reasons. First, the fact the Guidelines may not be followed in all circumstances does not result in a level of unpredictability that "prevents any meaningful analysis from being conducted." The Guidelines will be followed absent circumstances necessitating departure. Accordingly, there is sufficient certainty that the Guidelines will be implemented at some point in time.

NMFS is also capable of meaningfully assessing potential impacts to listed species stemming from NPS' adherence to the Guidelines at the programmatic level. Indeed, NMFS already completed formal consultation with the United States Forest Service (USFS) on the continued aerial application of fire retardants according to the USFS' 2000 *Guidelines for Aerial Delivery of Retardant or Foam Near Waterways*. The Guidelines attached to the RNSP BA include "Guidelines for Aerial Delivery of Retardant or Foam Near Lakes, Rivers, Streams and Ponds" that are substantially similar to the USFS' 2000 guidelines. Programmatic consultation evaluating the effectiveness of NPS' use of the Guidelines on NPS lands is feasible and appropriate.

Furthermore, NMFS does not believe that the NPS' use of the Guidelines can be adequately assessed under the emergency consultation procedures. As one court stated regarding USFS' use of fire retardant: "[t]he emergency exception is meant for unexpected exigencies. The use of fire retardant by the USFS is not unexpected but guaranteed; the only question is when and where it will be used. There is no reason why the USFS cannot conduct formal consultation with FWS and no reason to find that the ESA requires anything less."¹ NMFS believes emergency consultation procedures would be appropriate to assess the impacts of a particular wildfire suppression activity *after* programmatic consultation on the NPS' use of the Guidelines.

The current proposed action, i.e. the RNSP Plan, would be effective through 2015 and consists of prescribed burning within different ecosystem types and maintenance activities used for firefighting. Only two proposed burn units, Wildcat and Pig Pen, result in adverse effects to federally listed salmonids.

The enclosed biological opinion is based on NMFS' review of information provided with RNSP's August 13, 2009, request for formal consultation, the BA for the Plan, a March 12, 2009, site visit, and several e-mails that occurred during the consultation. The biological opinion addresses potential adverse effects on the following listed species' Evolutionarily Significant Unit (ESU) or Distinct Population Segment (DPS) and designated critical habitat in accordance with section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C 1531 § et seq.):

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

California Coastal (CC) Chinook Salmon ESU
(*O. tsawytscha*)
Threatened (June 28, 2005, 70 FR 37160)
Designated critical habitat (September 2, 2005, 70 FR 52488)

¹ *Forest Service Employees for Environmental Ethics v. United States Forest Service*, 397 F.Supp.2d 1241, 1257 (D. Mont. 2005).

Northern California (NC) steelhead DPS

(*O. mykiss*)

Threatened (January 5, 2006, 71 FR 834)

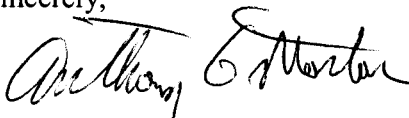
Designated critical habitat (September 2, 2005, 70 FR 52488)

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

The enclosed EFH consultation (Enclosure 2) was prepared pursuant to section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA). The proposed action includes areas identified as EFH for coho salmon and Chinook salmon under the Pacific Coast Salmon Fishery Management Plan. Based on our analysis, NMFS concludes that the project would adversely affect EFH for coho salmon and Chinook salmon and three EFH conservation recommendations are provided in the EFH consultation. The MSFCMA and Federal regulations (50 CFR 600.920) to implement the EFH provisions require Federal action agencies to provide a written response to EFH Conservation Recommendations within 30 days of receipt. The final response must include a description of measures proposed to avoid, mitigate, or offset the adverse impacts of the activity. If the response is inconsistent with the EFH Conservation Recommendations, an explanation of the reasons for not implementing them must be included.

If you have any questions regarding these consultations, please contact Shari Anderson on my staff at (707) 825-5186.

Sincerely,


for Rodney R. McInnis
Regional Administrator

Enclosures

1. Biological Opinion
2. EFH Consultation

cc: Copy to File: 151422SWR2009AR00052

Enclosure 1

Endangered Species Act - Section 7 Consultation

BIOLOGICAL OPINION DRAFT

ACTION AGENCY: Redwood National and State Parks (RNSP)

ACTIVITY: 2010 Redwood National Park Fire Management Plan and Prescribed Burning in Prairie Creek Redwoods and Jedediah Smith Redwoods State Parks in Redwood National and State Parks (RNSP)

CONSULTATION CONDUCTED BY: Southwest Region, National Marine Fisheries Service

FILE NUMBER: 151422SWR2009AR00052

DATE ISSUED: FEB 9 2010

I. BACKGROUND AND CONSULTATION HISTORY

On June 10, 2002, the NOAA's National Marine Fisheries Service (NMFS) issued a letter of concurrence (NMFS Administrative File # 51422SWR02AR6328) for Redwood National and State Parks' (RNSP) fire management activities, which had many similar actions to the current proposed action. A subsequent letter of concurrence from NMFS was dated January 21, 2005 (NMFS Administrative File # 151422SWR04AR9140). Unlike the previous consultations, the current proposed actions include burning activities in close proximity to anadromous reaches. A large number of verbal and written communications were associated with the past consultations. All pertinent NMFS recommendations and concerns from the past consultations have been incorporated into the current proposed action.

An interagency consultation team meeting was held on February 10, 2009, and was attended by Redwood National Park personnel, Shari Anderson of NMFS as well as representatives of other state and federal regulatory agencies. The proposed action was described and preliminary determinations and information needs were outlined. A field visit by RNSP and NMFS staff on March 12, 2009, was taken to view a previous second growth prescribed burn unit and the proposed Wildcat second growth prescribed burn unit. Pre and post prescribed burn stream sedimentation monitoring needs were discussed. A draft biological assessment was sent to NMFS on June 8, 2009, and comments were provided to RNSP on June 22, 2009. On August 13, 2009, NMFS received a biological assessment and a request for Endangered Species Act (ESA) section 7 formal consultation from RNSP for the federally threatened Southern Oregon/Northern California Coast (SONCC) coho salmon (*Oncorhynchus kisutch*), California Coastal (CC) Chinook salmon (*O. tshawytscha*), Northern California (NC) steelhead (*O. mykiss*),

and their designated critical habitats. A complete administrative record for this consultation is on file at the Arcata Area Office of NMFS. No effects are expected to the Southern Resident killer whale (*Orcinus orca*; April 4, 2007, 72 FR 16284) and the Southern Distinct Population Segment (DPS) of the North American green sturgeon.

II. DESCRIPTION OF THE PROPOSED ACTION

RNSP in California include Redwood National Park, under the jurisdiction of the National Park Service (NPS), and three state parks – Prairie Creek Redwoods State Park, Del Norte Coast Redwoods State Park, and Jedediah Smith Redwoods State Park – under the jurisdiction of the California Department of Parks and Recreation (CDPR). A joint (federal and state) general plan provides comprehensive guidance for managing the parks and is required by federal and state laws. Under this plan, all activities that fall within either federal or state boundaries of RNSP will be considered during Section 7 consultations.

A. Redwood National Park 2010 Fire Management Plan

The RNSP proposes to implement a Fire Management Plan (Plan) that will be effective through 2015, and consists of wildfire suppression, prescribed burning within different vegetation types, and maintenance activities used for firefighting.

1. Prescribed Burning in Prairies (Grasslands), Oak Woodlands, Pine Woodlands and Second Growth Coniferous Forest

Prescribed fire will be used to treat approximately 4,591 acres of prairie, oak woodland and pine woodland. Specific burn units and their relative distance to anadromous salmonid habitat are listed below in Table 1. No units contain a perennial stream within the unit boundaries. Burn unit locations are described in Appendix 1.

Table 1. Prescribed burn units and number of perennial and intermittent streams in proximity to unit. Prescribed burn start dates vary between units due to proximity to potentially suitable habitat of listed terrestrial species or migratory birds.

Burn Unit Name	Acres	Time of year burning proposed	Number of intermittent streams w/in 100 feet of burn unit	Number of perennial streams w/in 150 feet of burn unit	Number of perennial streams w/in 300 feet of burn unit
Airstrip, Lower ¹	110	August 1 st to first rains	1	0	1
Airstrip, Upper ¹	102	August 1 st to first rains	0	0	0

Burn Unit Name	Acres	Time of year burning proposed	Number of intermittent streams w/in 100 feet of burn unit	Number of perennial streams w/in 150 feet of burn unit	Number of perennial streams w/in 300 feet of burn unit
C-10 ⁴	339	September 16 th to first rains	3	0	0
Child's Hill ¹	561	August 1 st to first rains	3	0	0
Copper Creek ¹	148	August 1 st to first rains	2	0	0
Counts, Upper ¹	118	August 1 st to first rains	1	0	0
Counts, Lower ¹	220	September 16 th to first rains	1	0	1
Coyote Creek ²	1,063	September 16 th to first rains	5	0	0
Davison ¹	10	September 16 th to first rains	0	0	1
DeMartin ²	5	September 16 th to first rains	0	0	0
Dolason, Lower ²	220	September 16 th to first rains	0	0	0
Dolason, Upper ²	94	September 16 th to first rains	0	0	0
Dooleyville ²	111	September 16 th to first rains	1	0	1
Eastside ¹	107	August 1 st to first rains	0	0	0
Elk Camp, Lower ¹	244	September 16 th to first rains	1	0	0
Elk Camp, Upper ¹	37	August 1 st to first rains	0	0	0

Burn Unit Name	Acres	Time of year burning proposed	Number of intermittent streams w/in 100 feet of burn unit	Number of perennial streams w/in 150 feet of burn unit	Number of perennial streams w/in 300 feet of burn unit
Enderts ⁵	109	August 1 st to first rains	1	0	0
Gans, Lower ¹	7	September 16 th to first rains	0	0	0
Gans, Upper ¹	17	September 16 th to first rains	0	0	0
Holter Ridge Beargrass ⁴	5	September 16 th to first rains	0	0	0
Lagoon Creek ⁵	68	September 16 th to first rains	0	1*	0
Little Bald Hills ³	1,470 ^a	August 1 st to first rains	6	0	0
Lyons, Lower ²	143	August 1 st to first rains	2	0	0
Lyons, Upper ²	208	August 1 st to first rains	0	0	0
Mainstem ¹	166	August 1 st or September 15 th to first rains	2	0	1
Major Creek ⁵	7	August 1 st to first rains	0	1*	1*
Maneze ²	226	August 1 st to first rains	0	0	0
Mid Basin ²	129	August 1 st to first rains	3	0	0
Pig Pen ¹	69	September 16 th to first rains	0	1	1
School House ¹	300	August 1 st to first rains	0	0	0
South Boundary ¹	86	September 16 th to first	1	0	0

Burn Unit Name	Acres	Time of year burning proposed	Number of intermittent streams w/in 100 feet of burn unit	Number of perennial streams w/in 150 feet of burn unit	Number of perennial streams w/in 300 feet of burn unit
		rains			
Tick ¹	34	September 16 th to first rains	0	0	0
Upper K&K ⁴	40	September 16 th to first rains	0	0	0
Wildcat ⁴	1,054	September 16 th to first rains	6	1	0
Williams Ridge ¹	118	August 1 st to first rains	0	0	0
Wooden Gate ¹	243	August 1 st to first rains	0	0	0
Vegetation type within unit: ¹ grassland, ² grassland and oak woodland, ³ Jeffrey pine woodland, ⁴ second growth conifer, ⁵ coastal grass and scrub.					
*Non anadromous watershed.					
^a Only 50 acres within the larger prescribed burn planning unit will be burned per year.					

Preparation methods will include cutting grass with line trimmers and mowers along fire lines, fire line construction with chainsaws and hand tools, installation of fire hoses and setting up and filling portable water tanks at strategic locations. Fire line construction will vary according to fuel type and time of year to ensure firefighter safety and allow for control of the prescribed fire. Burns scheduled late in the year that are dependent upon precipitation will utilize “wet” lines consisting of either naturally occurring forest edge moisture or direct application of water to vegetation prior to ignition. Where fire lines are constructed, they will be dug to mineral soil up to four feet wide. Fire lines will be rehabilitated after the prescribed burn by replacing the topsoil. Any fire lines that encroach upon any intermittent or perennial stream will have water bars installed within 300 feet of the intermittent or perennial stream. No shading riparian vegetation will be removed during fire line construction, only understory shrubs and trees and low hanging branches will be removed. Existing canopy cover will be maintained along all riparian areas within 300 feet of any intermittent or perennial stream.

In grasslands, additional mowing of fuels adjacent to the fire line may occur, while in oak woodlands or areas bordered by dense, young conifers, adjacent ladder fuels will be cleared (i.e. brush cut back, lower limbs removed, small diameter seedlings/pole sized trees cut). In second growth units, small pole sized trees within four feet of fire lines may be cut and limbs up to six feet above ground on larger trees may be removed. No conifers greater than 18 inches diameter at breast height (DBH) will be cut in any unit. Debris will be scattered within the burn unit when feasible or hand piled and burned during the winter wet season in areas of heavier accumulation. No piles will be burned within the riparian area (i.e. within 300 feet) of any intermittent or perennial stream.

Treatment prescriptions will vary between units to meet specific unit objectives. Prescriptions will include flame lengths between 1 and 27 feet, and rates of spread between 3 and 60 chains per hour. Ignition will be accomplished using drip torches, fusees, and aerial ignition. The personnel committed to each burn may include up to 20 overhead (management personnel) positions, two handcrews, four engines, one helicopter, one water tender, portable tanks and pumps, hose and related equipment. No water will be drafted from anadromous fish bearing streams.

All structures (historic or otherwise) within the burn units will be protected using standard methods including construction of fire lines, fuel reduction and pretreatment with water and/or foam. No foam applications will be made within 300 feet of any intermittent or perennial streams.

Post burn vegetation monitoring will be conducted to ensure burn objectives are achieved including fire effects plots which have already been installed. Pre and post burn stream monitoring will occur at the mouth of Copper Creek within the Wildcat unit (Appendix 1). Specifically, pre and post fire data will be collected by using ISCO pumping samplers to collect physical samples and then test for suspended sediment concentration, pH, and organic matter content. Basic physical metrics such as fine sediment in pools and particle size distribution will also be assessed as well as pre and post burn photo stations.

2. Shaded Fuel Breaks

Five shaded fuel breaks will be created or maintained: 1) along Holter Ridge Road (aka Lost Man Creek Trail)/B Line Road from the Bald Hills Road north to US Highway 101, 2) along the Bald Hills Road from the Holter Ridge Road junction to Elk Camp Prairie, 3) along the Wolf Creek Outdoor School Access Road and housing complex/fire cache, 4) around the Hiouchi park housing and fire cache complex, and 5) around the Howland Hills Outdoor School access road and complex (Appendix 1). The thinning provides more secure and defensible park boundaries and developments and escape routes in the event of a wildfire. Mechanical thinning within 100 ft of roads or buildings involves using chainsaws to cut trees less than 12 inches DBH, brush and tree limbs that could provide ladder fuels into the forest canopy. Canopy cover will be maintained above 60% where it exists. Cut trees and limbs will be piled away from live trees and large logs and snags (i.e. logs >36 inches diameter on the wide end and longer than 10 feet and snags >24 inches DBH) within the units or on the roads will either be burned during the wet season outside of the burn timing restrictions or chipped with a mechanical chipper. All five of

the fuel breaks are located along ridge tops well away from any stream course or are at least 300 feet from the nearest perennial stream.

3. Historic Structure Annual Hazard Fuel Reduction

Seven historic structures, Elk Camp Barn, Dolason Barn, Lyons Ranch Barn and Bunkhouse, Dooleyville Line Shack, Long Ridge Sheepshead, Coyote Creek Barn, and Coyote Creek Cabin will have hazardous fuels (e.g., overgrown grass and brush within 40 feet of structures) annually cleared around them to provide some protection from wildfires (Appendix 1). All structures are at least 300 feet from any intermittent or perennial stream.

4. Pond Maintenance

Four existing, human-made ponds (formerly used as water sources for livestock or logging operations) will have low growing brush and sapling trees cleared in and around them with line trimmers and chainsaws to improve access and maintain them as firefighting water sources for prescribed fires, wildfires or both. The four ponds (i.e., M-Line, Elk Camp Upper, Elk Camp Lower, and Coyote; Appendix 1) are all located on the upper thirds of watersheds and are fed by small springs. They are all located well upslope of anadromous reaches.

5. Holding Tank Placement

Four 2,500 gallon water tanks will be placed on or near roads close to ridge tops to provide water sources for wild land firefighting. These tanks will be located along Bridge Creek Road – mile 3.5, Holter Ridge Road South, Little Bald Hills and Ranch Road – Mid Basin (Appendix 1). The tanks will fill with rainwater collected by guzzler-like attachments. Most tanks will be placed on a gravel base on existing flat ground.

B. California Department of Parks and Recreation Prescribed Burning

1. Old Growth Forest Units

Two old growth forest units are proposed to be burned during the next five years on California Department of Parks and Recreation (CDPR) land within RNSP. The Boyes Prairie old growth burn unit is 30 acres of old growth redwood dominated forest on the eastern side of the Boyes Prairie grassland unit. The Peterson Memorial Trail old growth burn unit is 3 acres of flat, bottomland redwood dominated forest completely surrounded by foot trails. Both units are located on flat ground at least 300 feet from any intermittent or perennial stream (Appendix 1).

Broadcast burning will be ignited with drip torches or fusees. The prescription for these units calls for a “cool” understory burn with the objective of consuming smaller ground fuels, shrubs and small trees (< 12 inches DBH). Fire modeling and stand sampling indicates that within the Boyes Prairie old growth burn unit, two to six Sitka spruce/western hemlock trees taller than 120 feet will be killed by the fire. The Peterson Memorial Trail old growth burn unit is composed entirely of redwood and no trees >12 inches DBH are expected to be killed by the prescribed

burn. Large logs (>36 inches in diameter and at least 10 feet long) will be extinguished completely during the initial mop up period to ensure they are not completely consumed. Fire, however, will not be excluded from large logs. Large logs will be allowed to partially burn if they ignite. Fire crews will be supported by at least two engines and temporary water storage tanks, and will have the ability to lay hose to any portion of the burn units and access to a helicopter to ensure control of the prescribed burn.

2. Coastal Scrub Unit

The Ossagon prescribed burn unit is 115 acres of coastal scrub brushland located on an ocean facing slope adjacent to the north end of Gold Bluffs Beach (Appendix 1). The unit is not located in a watershed containing anadromous fish.

3. Coastal Grassland Unit

The 166 acre Boyes Prairie grassland burn unit is located on flat ground at least 300 feet from any intermittent or perennial stream (Appendix 1). Burning will occur between September 16th and October 31st.

III. ACTION AREA

The action area is defined as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR § 402.02). The action area encompasses the lower half mile of Copper Creek and a portion of Redwood Creek that extends from the Copper Creek confluence downstream to include the Pig Pen unit (river miles 15 through 19 on Redwood Creek). The proposed action also includes the Ossagon, DeMartin, Enderts, Lagoon Creek, Major Creek, and Little Bald Hills units within the National and State Park boundaries. However, these areas were excluded from the action area because no effects to listed salmonids are expected.

IV. STATUS OF THE SPECIES

In this opinion, NMFS assesses the status of Southern Oregon/Northern California Coast (SONCC) coho salmon, California Coastal (CC) Chinook salmon, Northern California (NC) steelhead by examining four types of information, all of which help us understand a population's 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 information to evaluate these population viability parameters in a quantitative sense, NMFS has used existing information to determine the general condition of each population and factors responsible for the current status of each ESU.

We use these population viability parameters as surrogates for numbers, reproduction, and distribution, the criteria found within the regulatory definition of jeopardy (50 CFR 402.20). For example, the first three parameters are used as surrogates for numbers, reproduction, and distribution. We relate the fourth parameter, diversity, 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.

Table 2 presents a summary of the *Federal Register* (FR) Notice dates and citations, and geographic distributions for these species and critical habitats. This section of the Opinion updates the status of critical habitat, and population trends at the ESU or DPS scale. Updated information on abundance and distribution, along with an updated description of designated critical habitat in the action area, is provided in the *Environmental Baseline* section of this Opinion.

Table 2. The scientific name, listing status under the ESA, FR notice citation, and geographic distribution of the ESUs and DPS addressed in this Opinion.

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

A. Species Life History, Distribution, and Abundance

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

1. NC Steelhead

a. Life History

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

b. Current Distribution and Abundance

The NC steelhead DPS includes all naturally spawning populations of steelhead in California coastal river basins from Redwood Creek, Humboldt County, to just south of the Gualala River, Mendocino County (Spence *et al.* 2008). This distribution includes the Eel River, the third largest watershed in California, with its four forks (North, Middle, South, and Van Duzen) and their extensive tributaries. Spence *et al.* (2008) identified 42 historically independent populations in the DPS based on habitat availability and gene flow among watersheds. An additional 33 small populations are likely dependent upon immigration from the more permanent populations (Bjorkstedt *et al.* 2005). With few exceptions, NC steelhead are present wherever streams are accessible to anadromous fishes and have sufficient flows. Big and Stone lagoons, between Redwood Creek and Little River, contain steelhead following their opening to the ocean in the early winter, although the source of these fish is unknown (Sparkman 2007, Moyle *et al.* 2008).

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

1996, Busby *et al.* 1996). In the mid-1960s, California Department of Fish and Game (CDFG) estimated steelhead spawning in many rivers in this ESU to total about 198,000 (McEwan and Jackson 1996).

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

Steelhead abundance estimates are summarized in the most recent NMFS west coast steelhead status reviews (Good *et al.* 2005). The Biological Review Team (BRT) made the following conclusions that, albeit with limited data: (1) population abundances are low, compared to historical estimates; (2) recent trends are downward (except for a few small summer-run stocks), and (3) summer-run steelhead abundance was “very low” (Good *et al.* 2005). Lack of data on run sizes within the DPS was a major source of uncertainty in the BRT’s assessment.

2. CC Chinook salmon

a. Life History

Adult Chinook salmon reach sexual maturity usually at 3 to 5 years, and die soon after spawning. Precocious 2 year olds, especially male jacks, make up a relatively small percentage of the spawning population. Healey (1991) describes two basic life history strategies for Chinook salmon, stream-type and ocean-type, within which there is a strategy that provides variation within the species. Like most salmonids, Chinook salmon have evolved with variation in juvenile and adult behavioral patterns, which can help decrease the risk of catastrophically high mortality in a particular year or habitat (Healey 1991). Spring-run Chinook salmon are often stream-type (Healey 1991, Moyle 2002). Adults return to lower-order headwater streams in the spring or early summer before they reach sexual maturity, and hold in deep pools and coldwater areas until they spawn in early fall (Healey 1991, Moyle 2002). This strategy has been allowing spring-run Chinook salmon to take advantage of mid-elevation habitats inaccessible during the summer and fall due to low flows and high water temperatures (Moyle 2002). Juveniles emerge from the gravel in the early spring and typically spend one year in freshwater before migrating downstream to estuaries and then the ocean (Moyle 2002). A CDFG outmigrant trapping program on the Mad River found a small proportion of Chinook juveniles will over summer in freshwater (Sparkman 2002).

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

areas in the valley reaches of rivers, which are often too warm to support juvenile salmonid rearing in the summer (Moyle 2002).

b. Current Distribution and Abundance

Only fall-run Chinook salmon currently occur in the CC Chinook salmon ESU. Spring-run stocks no longer occur in the North-Central California Coast Recovery Domain which includes the region between Redwood Creek in Humboldt County and Aptos Creek in Santa Cruz County. However, information indicates that spring-run Chinook salmon existed in the Mad River and the North Fork and Middle Fork of the Eel River (Keter 1995, Myers *et al.* 1998, Moyle 2002).

CC Chinook salmon are distributed at the southern end of the species' North American range; only Central Valley fall Chinook are found spawning further south. NMFS identified four regions of this portion of the California coast with similar basin-scale environmental and ecological characteristics (Bjorkstedt *et al.* 2005). Sixteen watersheds were identified in these four regions that have minimum amount of habitat available to support independently viable populations. In the *North Mountain-Interior Region*, the Upper Eel and Middle Fork Eel Rivers contain functionally independent CC Chinook stocks, while the Lower Eel and Van Duzen Rivers have the potential to be independent. Chinook salmon are annually observed in the Middle Fork Eel River, in Black Butte River, and near Williams Creek. They continue to be observed annually in the Outlet Creek drainage and in the smaller tributaries feeding Little Lake valley (Harris 2009). In the *North Coastal Region*, Redwood Creek and the Mad, Lower Eel, South Fork Eel, Bear and Mattole Rivers all contain sufficient habitat for functionally independent CC Chinook salmon populations. NMFS also identified Little River and Humboldt Bay tributaries as containing potentially independent populations. In the *North-Central Coastal Region*, numerous watersheds in Mendocino County contain (or contained) small runs of CC Chinook salmon that are dependent on self-sustaining stocks in Ten Mile, Noyo, and Big Rivers. Along the *Central Coastal Region*, the Navarro, Garcia and Gualala Rivers historically had independent populations but apparently no longer do (Moyle *et al.* 2008). Additionally, the Russian River appears to support a self-sustaining population although the role of hatcheries and straying from the Eel River (by fish attracted to Eel River water that has been diverted into the Russian River) is uncertain. Seventeen additional watersheds were identified by NMFS to contain CC Chinook salmon, but due to limited habitat were believed not to support persisting populations of these fish (Good *et al.* 2005). While Chinook salmon are also encountered in the San Francisco Bay region, these fish most likely originated from Central Valley populations and are not included in the ESU (Moyle *et al.* 2008).

Available information on the historical abundance of CC Chinook salmon are summarized in Myers *et al.* (1998). The following are excerpts from this document:

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

Observed widespread declines in abundance and the present distribution of small populations with sometimes sporadic occurrences contribute to the risks faced in this ESU. Concerns about current abundances relative to historical abundances, mixed trends in the few time series available, and potential extirpations in the southern part of the range contributed to the conclusion that CC Chinook salmon are “likely to become endangered” in the foreseeable future throughout all or a significant portion of their range (64 FR 50394, September 16, 1999; Good *et al.* 2005).

Good *et al.* (2005) found that historical and current information indicates that CC Chinook salmon populations are depressed in basins where they are being monitored. Uncertainty about low abundance, introduction of hatchery fish, and reduced distribution continues to substantially contribute to risks facing this ESU.

3. SONCC Coho salmon

a. Life History

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

b. Current Distribution and Abundance

Reliable current time series of naturally produced adult migrants or spawners are not available for SONCC coho salmon ESU rivers (Good *et al.* 2005). For a summary of historical and current distributions of SONCC coho salmon in northern California, refer to CDFG’s (2002) coho salmon status review, historical population structure by Williams *et al.* (2006), as well as the presence and absence update for the northern California portion of the SONCC coho salmon ESU (Brownell *et al.* 1999). Good *et al.* (2005) concluded that SONCC coho salmon were likely to become endangered in the foreseeable future, which is consistent with an earlier assessment (Weitkamp *et al.* 1995). Although there are few data, the information that is available for SONCC coho salmon indicates the component populations are in decline and strongly suggests the ESU is at risk (Weitkamp *et al.* 1995, CDFG 2002, Good *et al.* 2005). NMFS (2001)

concluded that population trend data for SONCC coho salmon from 1989 to 2000 show a continued downward trend throughout most of the California portion of the SONCC coho salmon ESU.

The main stocks in the SONCC coho salmon ESU (Rogue, Klamath, and Trinity Rivers) remain heavily influenced by hatcheries and have little natural production in mainstem rivers (Weitkamp *et al.* 1995, Good *et al.* 2005). The listing of SONCC coho salmon includes all hatchery-produced coho salmon in the ESU range (70 FR 37160, June 28, 2005). Trinity River Hatchery maintains high production, with a significant number of hatchery SONCC coho salmon straying into the wild population (NMFS 2001). The Mad River Hatchery has ceased coho salmon production in 1999. Iron Gate Hatchery has had a production goal of 75,000 juvenile coho since 1966. This production goal had been substantially exceeded until 1994 when the hatchery reduced production to be more consistent with their production goals. The apparent decline in wild production in these rivers, in conjunction with significant hatchery production, suggests that natural populations of coho salmon are not self-sustaining (Weitkamp *et al.* 1995, Good *et al.* 2005). Coho salmon populations continue to be depressed relative to historical numbers, and there are strong indications that breeding groups have been lost from a significant percentage of streams within their historical range (Good *et al.* 2005).

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

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

Scientists at the NMFS Southwest Fisheries Science Center compiled a presence-absence database for the SONCC coho salmon ESU similar to that developed by CDFG (Good *et al.* 2005). The data set includes information for coho salmon streams listed in Brown and Moyle (1991), as well as other streams that NMFS found historical or recent evidence of coho salmon presence. The database is a composite of information contained in the NMFS (2001) status review update, additional information gathered by NMFS since publication of the 2001 status review, data used in the CDFG (2002) analysis, and additional data compiled by CDFG (Jong 2002) for streams not on the Brown and Moyle (1991) list. Using the NMFS database, Good *et al.* (2005) compiled information on the presence of coho salmon in streams throughout the SONCC ESU (Figure 1), which closely matched the results of Brown and Moyle (1991).

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

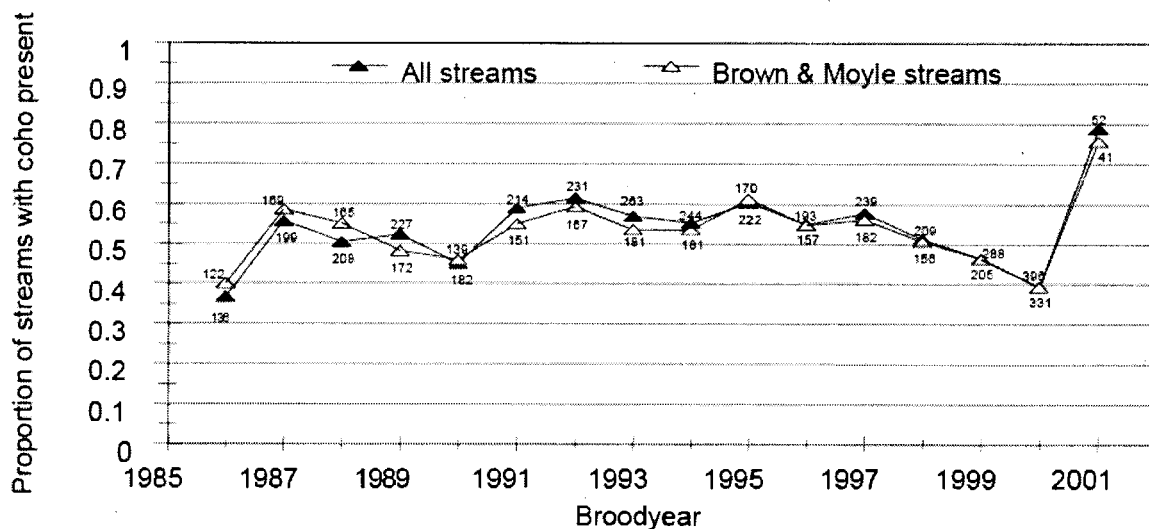


Figure 1. Proportion of surveyed streams where coho salmon were detected (Good *et al.* 2005). The number of streams surveyed is shown next to data.

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

The factors that have caused declines in the SONCC coho salmon ESU, CC Chinook salmon ESU, and NC steelhead DPS are similar. These factors include habitat loss due to dam building, degradation of freshwater habitats due to a variety of agricultural and forestry practices, water diversions, urbanization, mining, and severe recent flood events, which are exacerbated by land use practices (Good *et al.* 2005). Sedimentation and loss of spawning gravels associated with poor forestry practices and road building are particularly acute problems that can reduce the productivity of salmonid populations. Nonnative Sacramento pikeminnow (*Ptychocheilus grandis*) occupy the Eel River basin and prey on juvenile salmonids (Good *et al.* 2005) and compete for the same resources. Droughts and unfavorable ocean conditions in the late 1980s and early 1990s were identified as further likely causes of decline (Good *et al.* 2005).

1. Timber Harvest

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

In the smaller Class II and III streams, recruited wood usually cannot be washed away, so logs remain in place and act as check-dams that store sediment eroded from hillsides (Reid 1998). Sediment storage in smaller streams can persist for decades (Nakamura and Swanson 1993). In assessing the characteristics of Class III watercourses including within the Mad River watershed, Simpson Resource Company (2002) found that coniferous woody debris was the predominant channel bed grade control. Furthermore, where channels are prone to sediment debris flows, woody debris and adjacent riparian stands can provide roughness that limit the distance debris flows may travel down into channels [Ketcheson and Froehlich 1978 Pacific Watershed Associates (PWA) 1998]. For example, in Bear Creek, a tributary to the Eel River, PWA (1998) noted that debris flows now travel farther downstream and channel aggradation extends farther downstream because of inadequate large wood from landslide source areas and streamside vegetation.

On larger channels, wood again stores sediment, and also provides a critical element in the habitat of aquatic life forms (Spence *et al.* 1996, Reid 1998). Sullivan *et al.* (1987) found that woody debris forms abundant storage sites for sediment in forest streams as large as fourth-order (20 to 50 km² drainage area), where storage is otherwise limited by steep gradients and confinement of channels between valley walls. Studies of this storage function in Idaho by Megahan and Nowlin (1976) and in Oregon by Swanson and Lienkamper (1978) indicated that annual sediment yields from small forested watersheds are commonly less than 10 percent of the sediment stored in channels.

In fish-bearing streams, woody debris is important for storing sediment, halting debris flows, and decreasing downstream flood peaks, and its role as a habitat element becomes directly relevant for Pacific salmon species (Reid 1998). LWD alters the longitudinal profile and reduces the local gradient of the channel, especially when log dams create slack pools above or plunge pools below them, or when they are sites of sediment accumulation (Swanston 1991).

Cumulatively, the increased sediment delivery and reduced woody debris supply have led to widespread impacts to stream habitats and salmonids. These impacts include reduced spawning habitat quality, loss of pool habitat for adult holding and juvenile rearing, loss of velocity refugia, and increases in the levels and duration of turbidity which reduce the ability of juvenile fish to feed and, in some cases, may cause physical harm by abrading the gills of individual fish. These changes in habitat have led to widespread decreases in the carrying capacity of streams that support salmonids.

2. Road Construction

Road construction, whether associated with timber harvest or other activities, has caused widespread impacts to salmonids (Furniss *et al.* 1991). Where roads cross salmonid-bearing streams, improperly placed culverts have blocked access to many stream reaches. Land sliding and chronic surface erosion from road surfaces are large sources of sediment across the affected species' ranges. Roads also have the potential to increase peak flows and reduce summer base flows with consequent effects on the stability of stream substrates and banks. Roads have led to widespread impacts on salmonids by increasing the sediment loads. The consequent impacts on habitat include reductions in spawning, rearing and holding habitat, and increases in turbidity.

The delivery of sediment to streams can be generally considered as either chronically delivered, or more episodic in nature. Chronic delivery refers to surface erosion that occurs from rain splash and overland flow. More episodic delivery, on the order of every few years, occurs in the form of mass wasting events, or landslides, that deliver large volumes of sediment during large storm events.

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

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

continuously to streams may temporarily increase as bare soil is exposed and ditch roughness features which store and route sediment and also armor the ditch are removed. Hagans and Weaver (1987) found that fluvial hillslope erosion associated with roads in the lower portions of the Redwood Creek watershed produced about as much sediment as landslide erosion between 1954 and 1980. In the Mattole River watershed, which is south of the project area, the Mattole Salmon Group (1997) found that roads, including logging haul roads and skid trails, were the source of 76% of all erosion problems mapped in the watershed. This does suggest that, overall, roads are a primary source of sediment in managed watersheds.

Road surface erosion is particularly affected by traffic, which increases sediment yields substantially (Reid and Dunne 1984). Other important factors that affect road surface erosion include condition of the road surface, timing of when the roads are used in relation to rainfall, road prism moisture content, location of the road relative to watercourses, methods used to construct the road, and steepness on which the road is located.

3. Hatcheries

Hatchery operations potentially conflict with salmon recovery in the action area. Three large mitigation hatcheries release roughly 14,215,000 hatchery salmonids into SONCC coho salmon ESU rivers annually. Additionally, a few smaller hatcheries, such as Mad River Hatchery and Rowdy Creek Hatchery (Smith River) add to the production of hatchery fish. Both intra- and inter-specific interactions between hatchery salmon and SONCC coho salmon occur in freshwater and saltwater.

Spawning by hatchery salmon is often not controlled (ISAB 2002). Hatchery fish also stray into other rivers and streams, transferring genes from hatchery populations into naturally spawning populations (Pearse *et al.* 2007). This is problematic for wild fish because hatchery programs alter the genetic composition (Reisenbichler and Rubin 1999; Ford 2002), phenotypic traits (Hard *et al.* 2000; Kostow 2004), and behavior (Berejikian *et al.* 1996; Jonsson 1997) of reared fish. These genetic interactions between hatchery and naturally produced stocks decrease the amount of genetic and phenotypic diversity of a species by homogenizing once disparate traits of hatchery and natural fish. The result has been progeny with lower survival (McGinnity *et al.* 2003; Kostow 2004) and ultimately, a reduction in the fitness of the natural stock (Reisenbichler and McIntyre 1977; Chilcote 2003; Araki *et al.* 2007) and outbreeding depression (Reisenbichler and Rubin 1999; HSRG 2009).

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

natural salmonid populations, especially during periods of poor ocean conditions (Beamish *et al.* 1997a; Levin *et al.* 2001; Sweeting *et al.* 2003).

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

4. Water Diversions and Habitat Blockages

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

Habitat blockages have occurred in relation to road construction as discussed previously. However, hydropower, flood control, and water supply dams of different municipal and private entities, particularly in the Klamath Basin, have permanently blocked or hindered salmonid access to historical spawning and rearing grounds. Since 1908, the construction of the Potter Valley Project dams has blocked access to a majority of the historic salmonid habitat within the mainstem Eel River watershed. The percentage of habitat lost blocked by dams is likely greatest for steelhead because steelhead were more extensively distributed upstream than Chinook or coho salmon. As a result of migrational barriers, salmon and steelhead populations have been confined to lower elevation mainstems that historically only were used for migration and rearing. Population abundances have declined in many streams due to decreased quantity, quality, and spatial distribution of spawning and rearing habitat (Lindley *et al.* 2007). Higher temperatures at these lower elevations during late-summer and fall are also a major stressor to adult and juvenile salmonids.

5. Predation

Predation was not believed to play a major role in the decline of salmon populations; however, it may have had substantial impacts at local levels. For example, Higgins *et al.* (1992) and CDFG (1994) reported that Sacramento River pikeminnow have been found in the Eel River basin and are considered a major threat to native salmonids. Furthermore, populations of California sea lions and Pacific harbor seals, known predators of salmonids which occur in most estuaries and rivers where salmonid runs occur on the West Coast, have increased to historical levels because harvest of these animals has been prohibited by the Marine Mammal Protection Act of 1972 (Fresh 1997). However, salmonids appear to be a minor component of the diet of marine mammals (Scheffer and Sperry 1931, Jameson and Kenyon 1977, Graybill 1981, Brown and

Mate 1983, Roffe and Mate 1984, Hanson 1993). In the final rule listing the SONCC coho salmon ESU (May 6, 1997, 62 FR 24588), for example, NMFS indicated that it was unlikely that pinniped predation was a significant factor in the decline of coho salmon on the west coast, although they may be a threat to existing depressed local populations. NMFS (1997) determined that although pinniped predation did not cause the decline of salmonid populations, predation may preclude recovery of these populations in localized areas where they co-occur with salmonids (especially where salmonids concentrate or passage may be constricted). Specific areas where pinniped predation may preclude recovery cannot be determined without extensive studies.

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

6. Disease

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

Salmonids are exposed to numerous bacterial, protozoan, viral, and parasitic organisms in spawning and rearing areas, hatcheries, migratory routes, and the marine environment. However, disease outbreaks result only when the complex interaction among host, pathogen, and environment is altered. Natural populations of salmonids have co-evolved with pathogens that are endemic to the areas salmonids inhabit and have developed levels of resistance to them. In general, diseases do not cause significant mortality in native salmonid stocks in natural habitats (Bryant 1994, Shapovalov and Taft 1954), however, our understanding of mortality caused by pathogens in the wild is limited by the difficulty in determining the proximate and ultimate causes of death (e.g. when fish weakened by disease are consumed by predators). Within the last few decades, the introduction and prevalence of disease into wild stocks has become an increasing concern.

Ceratomyxosis, which is caused by *C. shasta*, has recently been identified as one of the most significant disease for juvenile salmon due to its prevalence and impacts in the Klamath Basin (Nichols *et al.* 2007). Mortality rates of hatchery coho from temporary and longer term exposures at various locations in the Klamath River vary between location, months and years, but are consistently high (10-90%) (Bartholomew 2005). Adults in the Klamath basin are also

largely impacted by disease, primarily from the common pathogens *Ichthyophthirius multifiliis* (Ich) and *Flavobacterium columnare* (columnaris) (NRC 2004). These pathogens were responsible for the 2002 fish kill on the Klamath River. Adult mortality from ich and columnaris are not as common as juvenile mortality from *C. Shasta* or *Parvicapsula minibicornis*. Very little current or historical information exists to quantify changes in infection levels and mortality rates attributable to these diseases for salmonids. However, studies suggest that naturally spawned fish tend to be less susceptible to pathogens than hatchery-reared fish (Sanders *et al.* 1992).

7. Fish Harvest

Salmon and steelhead once supported important tribal, commercial, and recreation fisheries. Over-utilization including harvest of adult NC steelhead, CC Chinook salmon, and SONCC coho for commercial and recreational fisheries has been identified as a significant factor in their decline. The proportion of harvest taken by sport and commercial harvesters has varied over the years according to abundance and social and economic priorities. Steelhead are rarely caught in the ocean fisheries. Ocean salmon fisheries are managed by NMFS to achieve Federal conservation goals for west coast salmon in the Pacific Coast Salmon Fishery Management Plan (FMP). The goals specify numbers of adults that must be allowed to spawn annually, or maximum allowable adult harvest rates. The key stocks in California are Klamath River fall-run Chinook salmon and Sacramento River fall-run Chinook salmon. In addition to the FMP goals, salmon fisheries must meet requirements developed through NMFS' intra-agency section 7 consultations.

NMFS' ESA consultation standard requires that the projected ocean harvest rates on age-4 Klamath River fall Chinook not exceed 16 percent. CDFG is developing an assessment and monitoring program for the Eel, Mattole, Mad, and Smith Rivers Fall and Spring Chinook to better develop management goals for harvest (PFMC 2006).

In addition to the reduction in numbers of spawners, ocean salmon fisheries may reduce the viability of Chinook salmon populations through negative effects on demographics. The capture of immature fish by ocean fisheries results in a reduction in the proportion of a cohort that spawns as older, larger fish. The reduction in the average age of spawning would be further intensified by genetic changes in the population due to the heritability of age of maturation (Ricker 1980, Hankin and McKelvey 1985, Hankin and Healey 1986). The higher productivity of larger and older female Chinook salmon results from the larger size and number of eggs they carry (Healy and Heard 1984). In addition larger, older salmon can spawn in larger substrates and create deeper egg pockets (Van den Berge and Gross 1984, Ricker 1980, Shelton 1955) that reduces scour potential. Reduced scour potential may be especially important to the productivity of redds in areas subject to high sediment loads and scour, such as those found in streams included in the action area for this consultation.

Ocean exploitation rates for coho salmon have dropped substantially in response to the non-retention regulations put in place in 1994 as well as general reductions in Chinook-directed effort. River harvest of wild coho salmon has not been allowed within the SONCC coho salmon ESU since 1994, with the exception of sanctioned tribal harvest for subsistence, ceremonial, and commercial purposes by the Yurok, Hoopa Valley, and Karuk tribes (CDFG 2002). SONCC-

origin coho salmon that migrate north of Cape Blanco experience incidental mortality due to hooking and handling in this fishery; however, total incidental mortality from this fishery and Chinook-directed fisheries north of Humbug Mountain, Oregon has been estimated to be less than 7% of the total mortality of coho salmon since 1999 (PFMC 1999, 2000).

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

Coho salmon harvested by Native American tribes are primarily incidental to larger Chinook salmon subsistence fisheries in the Klamath and Trinity Rivers. In neither basin is tribal harvest considered to be a major factor for the decline of coho salmon. The Yurok fishery has been monitored since 1992 and during that time harvest has ranged from 27 to 1,168 fish caught annually. Based on estimates of upstream escapement (in-river spawners and hatchery returns) this fishery is thought to amount to an average harvest rate of 4.4% from 1992 to 2003 when these fish were monitored from Weitchpec downstream to the ocean (CDFG 2004). Harvest management practiced by tribes is conservative and has resulted in limited impacts on stocks.

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

8. Climate Change

Climate change is postulated to have a negative impact on salmonids throughout the Pacific Northwest due to large reductions in available freshwater habitat (Battin *et al.* 2007).

Widespread declines in springtime snow water equivalent (SWE), which is the amount of water contained in the snowpack, have occurred in much of the North American West since the 1920s, especially since mid-century (Knowles and Cayan 2004, Mote 2006). This decrease in SWE can be largely attributed to a general warming trend in the western United States since the early 1900s (Mote *et al.* 2005, Regonda *et al.* 2005, Mote 2006), even though there have been modest upward precipitation trends in the western United States since the early 1900s (Hamlet *et al.* 2005). The largest decreases in SWE are taking place at low to mid elevations (Mote 2006, Van Kirk and Naman 2008) because the warming trend overwhelms the effects of increased precipitation (Hamlet *et al.* 2005, Mote *et al.* 2005, Mote 2006). These climactic changes have resulted in earlier onsets of springtime snowmelt and streamflow across western North America (Hamlet and Lettenmaier 1999, Regonda *et al.* 2005, Stewart *et al.* 2004), as well as lower flows in the summer (Hamlet and Lettenmaier 1999, Stewart *et al.* 2004).

The projected runoff-timing trends over the course of the twenty first century are most pronounced in the Pacific Northwest, Sierra Nevada, and Rocky Mountain regions, where the eventual temporal centroid of streamflow (*i.e.*, peak streamflow) change amounts to 20 to 40 days in many streams (Stewart *et al.* 2004). Although climate models diverge with respect to future trends in precipitation, there is widespread agreement that the trend toward lower SWE and earlier snowmelt will continue (Zhu *et al.* 2005, Vicuna *et al.* 2007). Thus, availability of water resources under future climate scenarios is expected to be most limited during the late summer (Gleick and Chalecki 1999, Miles *et al.* 2000). A one-month advance in timing centroid of streamflow would also increase the length of the summer drought that characterizes much of western North America, with important consequences for water supply, ecosystem, and wildfire management (Stewart *et al.* 2004). These changes in peak streamflow timing and snowpack will negatively impact salmonid populations due to habitat loss associated with lower water flows, higher stream temperatures, and increased human demand for water resources.

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

9. Ocean Conditions

Variability in ocean productivity has been shown to affect fisheries production both positively and negatively (Chavez *et al.* 2003). Beamish and Bouillion (1993) showed a strong correlation between North Pacific salmon production and marine environmental factors from 1925 to 1989. Beamish *et al.* (1997b) noted decadal-scale changes in the production of Fraser River sockeye salmon that they attributed to changes in the productivity of the marine environment. Warm ocean regimes are characterized by lower ocean productivity (Behrenfeld *et al.* 2006, Wells *et al.* 2006), which may affect salmon by limiting the availability of nutrients regulating the food supply, thereby increasing competition for food (Beamish and Mahnken 2001). Data from across the range of coho salmon on the coast of California and Oregon reveal there was a 72 percent decline in returning adults in 2007/08 compared to the same cohort in 2004/05 (MacFarlane *et al.* 2008). The Wells Ocean Productivity Index, an accurate measure of Central California ocean productivity, revealed poor conditions during the spring and summer of 2006, when juvenile coho salmon and Chinook salmon from the 2004/05 spawn entered the ocean (MacFarlane *et al.* 2008). Data gathered by NMFS suggests that strong upwelling in the spring of 2007 may have resulted in better ocean conditions for the 2007 coho salmon cohort (NMFS 2008). The quick response of salmonid populations to changes in ocean conditions (MacFarlane *et al.* 2008) strongly suggests that density dependent mortality of salmonids is a mechanism at work in the ocean (Beamish *et al.* 1997a, Levin *et al.* 2001, Greene and Beechie 2004).

10. Marine Derived Nutrients

Marine-derived nutrients (MDN) are nutrients that are accumulated in the biomass of salmonids while they are in the ocean and are then transferred to their freshwater spawning sites where the salmon die. The return of salmonids to rivers makes a significant contribution to the flora and fauna of both terrestrial and riverine ecosystems (Gresh *et al.* 2000), and has been shown to be vital for the growth of juvenile salmonids (Bilby *et al.* 1996, 1998). Evidence of the role of MDN and energy in ecosystems suggests this deficit may result in an ecosystem failure contributing to the downward spiral of salmonid abundance (Bilby *et al.* 1996). Reduction of MDN to watersheds is a consequence of the past century of decline in salmon abundance (Gresh *et al.* 2000).

C. Viability of the ESUs/DPS

1. Viability of the ESUs/DPS

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

a. Population Size

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

The final rule for the ESA listing of the CC Chinook ESU (70 FR 37160, June 28, 2005) stated “an assessment of the effects of [multiple] small artificial propagation programs on the viability of the ESU in-total concluded that they collectively decrease risk to some degree by contributing to local increases in abundance . . .” However, McElhany *et al.* (2000) cautioned “that the ESA’s primary focus is on natural populations in their native ecosystems, so when we evaluate abundance to help determine VSP status, it is essential to focus on naturally produced fish (*i.e.*, the progeny of naturally-spawning parents).” Based on these guidance documents, to the extent that hatchery-reared parents may boost production of naturally produced fish if and when they spawn in the wild, they may benefit the VSP parameter of population size. However, a population cannot be considered viable unless it has the minimum number of *naturally produced* spawners identified in recent guidance documents (Spence *et al.* 2008, Williams *et al.* 2008).

Although the operation of a hatchery tends to increase the abundance of returning adults (70 FR 37160), the reproductive success of hatchery-born salmonids spawning in the wild is far less than that of naturally produced ones (Araki *et al.* 2007). As a result, the higher the proportion of hatchery-born spawners, the lower the productivity of the population, as demonstrated by Chilcote (2003). Chilcote (2003) examined the actual number of spawners and subsequent recruits over 23 years in 12 populations of Oregon steelhead with varying proportions of hatchery-origin spawners and determined “. . . a spawning population comprised of equal numbers of hatchery and wild fish would produce 63 percent fewer recruits per spawner than one comprised entirely of wild fish.”

Status reviews for the SONCC coho salmon ESU, CC Chinook salmon ESU and the NC steelhead DPS concluded data were insufficient to set specific numeric population size targets for viability (Spence *et al.* 2008, Williams *et al.* 2008). In the absence of such targets, McElhany *et al.* (2000) suggested ESUs “. . . have been historically self-sustaining and the historical number and distribution of populations serves as a useful ‘default’ goal in maintaining viable ESUs.”

(1) NC steelhead. Steelhead abundance has been monitored at three dams in the NC steelhead ESU since the 1930s. Reviewers participating in the most recent status review determined these data showed population abundances were low relative to historical estimates, and that summer-run steelhead abundance was very low (Good *et al.* 2005). Regarding abundance, reviewers concluded “Although there are older data for several of the larger river systems that imply run sizes became much reduced since the early twentieth century, there are no recent data suggesting much of an improvement” (Good *et al.* 2005). Experts consulted during the status review gave this DPS a risk score of 3.7 (out of 5, with 5 equaling the highest risk) for the abundance category (Good *et al.* 2005), indicating its reduced abundance contributes significantly to long-term risk of extinction, and may contribute to short-term risk of extinction in the foreseeable future. NMFS concludes this DPS falls far short of McElhany’s ‘default’ goal of historic population numbers and distribution and is therefore not viable in regards to the population size VSP parameter.

(2) CC Chinook salmon. The most recent status review found continued evidence of: (1) low population sizes relative to historical abundance, (2) mixed trends in the few time series of abundance indices available for analysis, and (3) low abundances and potential extirpations of populations in the southern part of the ESU (Good *et al.* 2005). Experts consulted during the status review gave this ESU a mean risk score of 3.9 (out of 5) for the abundance category (Good *et al.* 2005), indicating its reduced abundance contributes significantly to long-term risk of extinction, and is likely to contribute to short-term risk of extinction in the foreseeable future. NMFS concludes this ESU falls far short of McElhany’s ‘default’ goal of historic population numbers and distribution and is therefore not viable in regards to the population size VSP parameter.

(3) SONCC coho salmon. The most recent status review concluded SONCC coho salmon populations “. . . continue to be depressed relative to historical numbers, and [there are] strong indications that breeding groups have been lost from a significant percentage of streams within their historical range (Good *et al.* 2005).” Experts consulted during the status review gave this

ESU a mean risk score of 3.8 (out of 5) for the abundance category (Good *et al.* 2005), indicating its reduced abundance contributes significantly to long-term risk of extinction, and is likely to contribute to short-term risk of extinction in the foreseeable future. NMFS concludes this ESU falls far short of McElhany's 'default' goal of historic population numbers and distribution and is therefore not viable in regards to the population size VSP parameter.

b. Population Productivity

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

(1) NC steelhead. As described in the *Species and Critical Habitat Description and Status* sections, populations of NC steelhead have declined substantially from historic levels. Experts consulted during the status review gave this DPS as risk score of 3.3 (out of 5) for the growth rate/productivity VSP category (Good *et al.* 2005), indicating its current impaired productivity level contributes significantly to long-term risk of extinction and may contribute to short-term risk of extinction in the foreseeable future. As productivity does not appear sufficient to maintain viable abundances in many NC steelhead populations, NMFS concludes this DPS is not viable in regards to the population productivity VSP parameter.

(2) CC Chinook salmon. As described in the *Species and Critical Habitat Description and Status* sections, populations of CC Chinook salmon have declined substantially from historic levels. Experts consulted during the status review gave this ESU as risk score of 3.3 (out of 5) for the growth rate/productivity VSP category (Good *et al.* 2005), indicating its current impaired productivity level contributes significantly to long-term risk of extinction and may contribute to short-term risk of extinction in the foreseeable future. As productivity does not appear sufficient to maintain viable abundances in many CC Chinook salmon populations, NMFS concludes this ESU is not viable in regards to the population productivity VSP parameter.

(3) SONCC Coho salmon. As described in the *Species and Critical Habitat Description and Status* sections, populations of SONCC coho salmon have declined substantially from historic levels. Experts consulted during the status review gave this ESU as risk score of 3.5 (out of 5) for the growth rate/productivity VSP category (Good *et al.* 2005), indicating its current impaired productivity level contributes significantly to long-term risk of extinction and may contribute to short-term risk of extinction in the foreseeable future. As productivity does not appear sufficient to maintain viable abundances in many SONCC coho salmon populations, NMFS concludes this ESU is not viable in regards to the population productivity VSP parameter.

c. Spatial Structure

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

(1) NC steelhead. Experts consulted during the most recent status review gave this DPS a mean risk score of 2.2 (out of 5) for the spatial structure and connectivity VSP category (Good *et al.* 2005), indicating it is unlikely this factor contributes significantly to risk of extinction by itself, but there is some concern that it may, in combination with other factors. Blockages to fish passage exist on two major rivers in the DPS and on numerous small tributaries (Good *et al.* 2005). These blockages degrade the spatial structure and connectivity of populations within the DPS. As the 'default' historic spatial processes described by McElhany *et al.* (2000) have likely not been preserved, NMFS concludes this DPS is not viable in regards to the spatial structure VSP parameter.

(2) CC Chinook salmon. Experts consulted during the most recent status review gave this ESU a mean risk score of 3.2 (out of 5) for the spatial structure and connectivity VSP category (Good *et al.* 2005), indicating its current spatial structure contributes significantly to long-term risk of extinction but does not in itself constitute a danger of extinction in the near future. However, Good *et al.* (2005) found that "reduction in geographic distribution, particularly for spring-run Chinook [salmon], and for basins in the southern portion of the ESU, continues to present substantial risk." As the 'default' historic spatial processes described by McElhany *et al.* (2000) have likely not been preserved, due to the reduction in geographic distribution described above, NMFS concludes this ESU is not viable in regards to the spatial structure VSP parameter.

(3) SONCC coho salmon. Relatively low levels of observed presence in historically occupied coho salmon streams (32 to 56 percent from 1986 to 2000) indicate continued low abundance in the California portion of the SONCC coho salmon ESU. The relatively high occupancy rate of historical streams observed in broodyear 2001 suggests that much habitat remains accessible to coho salmon (70 FR 37160, June 28, 2005). Brown *et al.* (1994) found survey information on 115 streams within the SONCC coho salmon ESU, of which 73 (64 percent) still supported coho salmon runs while 42 (36 percent) did not. The streams Brown *et al.* (1994) identified as presently lacking coho salmon runs were all tributaries of the Klamath River and Eel River systems. The BRT was also concerned about the loss of local populations in the Trinity, Klamath, and Rogue River basins (70 FR 37160, June 28, 2005). CDFG (2002) reported a decline in SONCC coho salmon occupancy, with the percent reduction dependent on the data sets used. Although there is considerable year-to-year variation in estimated occupancy rates, it appears that there has been no dramatic change in the percent of coho salmon streams occupied

from the late 1980s and early 1990s to 2000 (Good *et al.* 2005). In summary, recent information for SONCC coho salmon indicates that their distribution within the ESU has been reduced and fragmented, as evidenced by an increasing number of previously occupied streams from which they are now absent (NMFS 2001). However, extant populations can still be found in all major river basins within the ESU (70 FR 37160, June 28, 2005).

Experts consulted during the status review gave this ESU a mean risk score of 3.1 (out of 5) for the spatial structure and connectivity VSP category (Good *et al.* 2005), indicating its current spatial structure contributes significantly to long-term risk of extinction but does not in itself constitute a danger of extinction in the near future. As the 'default' historic spatial processes described by McElhany *et al.* (2000) have likely not been preserved, due to the habitat fragmentation described above, NMFS concludes this ESU is not viable in regards to the spatial structure VSP parameter.

d. Diversity

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

Negative effects to genetic diversity can result from hatchery production and stocking of hatchery-bred fish into wild streams. Hatchery-reared fish may be less genetically diverse than wild fish due to artificial selection, and may have originated in areas with different environmental conditions. Once in the hatchery, artificial selection for fish which survive well in the hatchery is likely to occur (Allendorf and Ryman 1987). If the hatchery-bred fish later interbreed with wild fish, they can reduce the genetic diversity of the wild population. Even if the overall genetic diversity of the wild population is unchanged, the introduction of non-native or less diverse genetic material into a native salmonid population can "dilute" the native population's adaptation to its local environment and make it less able to survive and reproduce (McElhany *et al.* 2000).

Genetic variability of wild stocks is naturally altered by straying from natural populations in nearby streams, which results in gene flow and often sustains or even increases the genetic diversity of a population over time. Straying is a normal and important part of the life history and evolution of Pacific salmon (Quinn 2005), but human activities can increase the rate of straying and cause more genetic interaction between populations than would naturally occur. Founding hatchery populations with broodstock from outside the watershed can make straying more common, as seen in the Columbia River (Pascual *et al.* 1995). Therefore, the genetic

makeup of hatchery steelhead from the Mad River could detrimentally affect steelhead in many other rivers within and even outside the geographic range of the NC steelhead DPS. Excessive straying can also be detrimental to wild fish populations born in their natal streams. When habitat becomes degraded, or inaccessible due to dams or road crossings, salmonid spatial distribution can become fragmented. In this situation, straying into non-natal streams is likely to increase when salmonids are denied access to their natal areas and are forced to enter other streams that are accessible. Increased stray rates would be expected to reduce population viability, particularly if the strays are accessing unsuitable habitat or are mating with genetically unrelated individuals (McElhany *et al.* 2000).

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

(1) NC steelhead. Millions of steelhead from outside the Mad River or outside the DPS have been stocked into rivers in the NC steelhead DPS many times since the 1970s. Bjorkstedt *et al.* (2005) documented 39 separate releases of this kind, and many of these releases occurred over multiple years. Of particular concern is the practice of rearing Eel River-derived steelhead in a hatchery on the Mad River before restocking them into the Eel River (Bjorkstedt *et al.* 2005). Over ten years, more than one-half million yearlings were reared and released in this way. This practice may have reduced the effectiveness of adult homing to the Eel River (Bjorkstedt *et al.* 2005). In addition, the abundance of summer-run steelhead was considered “very low” in 1996 (Good *et al.* 2005), indicating an important part of the life history diversity in this DPS may be at risk.

Experts consulted during the most recent status review gave this DPS a mean risk score of 2.5 (out of 5) for the diversity VSP category (Good *et al.* 2005), indicating this factor may contribute significantly to the long-term risk of extinction, but does not itself constitute a danger of extinction in the near future. NMFS concludes the current behavioral diversity in this ESU is much reduced compared to historic levels, so by McElhany’s criteria, it is not viable in regards to the diversity VSP parameter. In addition, the genetic integrity of the DPS may have been compromised by hatchery introductions.

(2) CC Chinook salmon. As of 2005, Bjorkstedt *et al.* concluded “most recent and ongoing artificial propagation efforts in the CC Chinook ESU are small in scale and restricted to supplementing depressed populations with progeny of local broodstock (2005).” The only current hatchery program for CC Chinook salmon is a supplementation program that uses local broodstock to boost populations in a tributary to the South Fork of the Eel River (Spence *et al.* 2008). The low hatchery production observed in the ESU is less likely to mask trends in ESU population structure and pose risks to ESU diversity than if hatchery production were higher, making hatchery production less of a concern for this ESU than others. The BRT did have concerns with respect to diversity that were based largely on the loss of spring-run Chinook salmon in the Eel River basin and elsewhere in the ESU, and to a lesser degree on the potential

loss of diversity concurrent with low abundance or extirpation of populations in the southern portion of the ESU (Good *et al.* 2005)."

Experts consulted during the status review gave this ESU a mean risk score of 3.1 (out of 5) for the diversity VSP category (Good *et al.* 2005). This score indicates the ESU's current genetic variability and variation in life history factors contribute significantly to long-term risk of extinction but do not, in themselves, constitute a danger of extinction in the near future. Low genetic diversity is therefore not considered the most important factor to this ESU's viability. However, Spence *et al.* (2008) expressed concern over the loss of spring-run populations in this ESU. NMFS concludes the current behavioral diversity in this ESU is much reduced compared to historic levels, so by McElhany's criteria it is not viable in regards to the diversity VSP parameter.

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

The high hatchery production in some systems in the SONCC coho salmon ESU may mask trends in ESU population structure and pose risks to ESU diversity (70 FR 37160, June 28, 2005). NMFS determined that the Cole Rivers Hatchery, Trinity River Hatchery, and Iron Gate Hatchery coho salmon hatchery programs are part of the ESU, and that these artificially propagated stocks are no more divergent relative to the local natural populations than what would be expected between closely related natural populations within the ESU (70 FR 37160, June 28, 2005). Within the 10 historical populations that have dams, 26.4 percent of historical habitat is currently located upstream of the dams (Table 5 in Williams *et al.* 2008). Loss of or limiting spawning and rearing opportunities are expected to adversely affect the species' basic demographic and evolutionary processes, causing a reduced potential that the ESU can withstand environmental fluctuations. Activities that affect evolutionary processes (*e.g.*, natural selection) have the potential to alter the diversity of the species.

The primary factors affecting the diversity of SONCC coho salmon appear to be the influence of hatcheries and out-of-basin introductions. In addition, some brood years have abnormally low abundance levels or may even be absent in some areas (*e.g.*, Shasta River and Scott River), further restricting the diversity present in the ESU. Experts consulted during the most recent status review gave this ESU a mean risk score of 2.8 (out of 5) for the diversity VSP category (Good *et al.* 2005). This score indicates the ESU's current genetic variability and variation in life history factors contribute significantly to long-term risk of extinction but do not, in themselves, constitute a danger of extinction in the near future. NMFS concludes the current phenotypic diversity in this ESU is much reduced compared to historic levels, so by McElhany's criteria it is not viable in regards to the diversity VSP parameter.

e. Summary

(1) **NC steelhead.** Based on the above descriptions of the population viability parameters, and qualitative viability criteria presented in Spence *et al.* (2008), NMFS believes that the NC steelhead DPS is currently not viable and is at an elevated risk of extinction.

(2) **CC Chinook salmon.** Based on the above descriptions of the population viability parameters, and qualitative viability criteria presented in Spence *et al.* (2008), NMFS believes that the CC Chinook salmon ESU is currently not viable and is at a moderate to high risk of extinction.

(3) **SONCC coho salmon.** Based on the above descriptions of the population viability parameters, and qualitative viability criteria presented in Williams *et al.* (2008), NMFS believes that the SONCC coho salmon ESU is currently not viable and is at moderate risk of extinction.

D. Description and Current Condition of Critical Habitats

1. Critical Habitat Description

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

This biological opinion does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 C.F.R. 402.2. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat.

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

a. NC Steelhead and CC Chinook Salmon

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

Critical habitat for NC steelhead was designated as occupied watersheds from the Redwood Creek watershed, south to and including the Gualala River watershed. Critical habitat for CC Chinook salmon was designated as occupied watersheds from the Redwood Creek watershed,

south to and including the Russian River watershed (70 FR 52488). Humboldt Bay and the Eel River estuary are designated as critical habitat for both the NC steelhead DPS and CC Chinook salmon ESU. Some areas within the geographic range were excluded due to economic considerations or because they overlap with Indian lands (**Error! Reference source not found.3**).

Table 3. Watersheds excluded, in whole or in part, from critical habitat designation for NC steelhead DPS and/or CC Chinook salmon (70 FR 52488).

NC Steelhead DPS		CC Chinook Salmon ESU	
Watershed Name	Area Excluded	Watershed Name	Area Excluded
Ruth	Entire watershed	Bridgeville	Entire watershed
Spy Rock	Tribal land	Spy Rock	Indian lands
North Fork Eel River	Entire watershed; Tribal lands	North Fork Eel River	Indian lands
Lake Pillsbury	Entire watershed	Eden Valley	Tributaries only; Indian lands
Eden Valley	Indian lands	Round Valley	Indian lands
Round Valley	Indian lands	Black Butte River	Entire watershed
		Wilderness	Entire watershed
		Navarro River	Entire watershed
		Santa Rosa	Entire watershed
		Mark West	Entire watershed

Designated critical habitat for NC steelhead and CC Chinook salmon overlaps the project action area. In designating critical habitat for NC steelhead and CC Chinook salmon, NMFS focused on the known primary constituent elements (PCEs) essential for the conservation of each species. PCEs are those sites and habitat components that support one or more life stages, including: (1) freshwater spawning, (2) freshwater rearing, (3) freshwater migration, (4) estuarine areas, (5) nearshore marine areas, and (6) offshore marine areas. Within the PCEs, essential elements of CC Chinook salmon and NC steelhead critical habitats include adequate (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, (10) safe passage conditions, and (11) salinity conditions (70 FR 52488, September 2, 2005).

b. SONCC Coho Salmon

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

Designated critical habitat for SONCC coho salmon overlaps the project area. In designating critical habitat for SONCC coho salmon, NMFS focused on the known physical and biological features within the designated area that are essential to the conservation of the species. These

essential features may include, but are not limited to, spawning sites, food resources, water quality and quantity, and riparian vegetation. Within the essential habitat types (spawning, rearing, migration corridors), essential features of coho salmon critical habitat include adequate (1) substrate, (2) water quality, (3) water quantity, (4) water temperature, (5) water velocity, (6) cover/shelter, (7) food, (8) riparian vegetation, (9) space, and (10) safe passage conditions (64 FR 24049, May 5, 1999). The current condition of critical habitat for SONCC coho salmon is discussed below in the *Conservation Value of the Critical Habitat* section.

c. Conservation Value of Critical Habitat

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

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

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

2. Condition of Critical Habitat

As part of the critical habitat designation process, NMFS convened Critical Habitat Analytical Review Teams (CHARTs) for steelhead and Chinook salmon. These CHARTs determined the conservation value of Hydrologic Subareas (HSAs) of watersheds under consideration. A CHART was not convened for SONCC coho salmon, because critical habitat had already been designated in 1999. NMFS determined the condition of SONCC coho salmon critical habitat based on other, readily available information.

a. CC Chinook Salmon

NMFS' assessment of the current condition of critical habitat for the CC Chinook salmon ESU shows PCE's for spawning and rearing habitat in the two major rivers within this ESU, the Eel and Russian Rivers, to be severely degraded by the persistence of highly turbid flows during the winter and spring, persisting even at low flows. The persistence is considered to be primarily a result of flows released from Scott Dam and Coyote Valley Dam (USACE 1982). Migration and rearing habitat PCEs in the Eel River (both riverine and estuarine) are degraded by diminished flows resulting from water storage in Lake Pillsbury (Scott Dam) and by interbasin diversions to the Russian River through the Potter Valley Project tunnel. Rearing habitat PCEs of the Russian River, both riverine and estuarine, are considered to be degraded as a result of land use patterns changing the channel configuration limiting available habitat, and a program of keeping the Russian River estuary breached throughout the year. Within the smaller coastal streams of the ESU, the status of critical habitat PCEs for rearing, spawning, and migration are considered degraded to a lesser extent.

For CC Chinook salmon, the CHART identified 45 occupied HSAs within the freshwater and estuarine range of the ESU. Eight HSAs were rated low in conservation value, 14 were rated medium, and 27 were rated high in conservation value (NMFS 2005). Within the ESU, CHART ratings and economic benefits analysis resulted in the designation of critical habitat with essential features for spawning, rearing and migration in approximately 1634 miles of occupied habitat. NMFS believes the status of CC Chinook salmon critical habitat in the 45 HSAs has not changed substantially since the 2005 assessment.

b. NC Steelhead

For NC steelhead, the CHART identified 50 occupied HSAs within the freshwater and estuarine range of the DPS. Nine HSAs were rated low in conservation value, 14 were rated medium, and 27 were rated high in conservation value (NMFS 2005). Within the DPS, the CHART ratings and economic benefits analysis resulted in designation of critical habitat with essential features for spawning, rearing and migration in approximately 3,148 miles of occupied stream habitat. NMFS believes the status of NC steelhead critical habitat in the 50 HSAs has not changed substantially since the 2005 assessment.

c. SONCC Coho Salmon

The condition of SONCC coho salmon critical habitat, specifically its ability to provide for their conservation, has been degraded from conditions known to support viable salmonid populations. NMFS has determined that present depressed population conditions are, in part, the result of the following human-induced factors affecting critical habitat: logging, agricultural and mining activities, urbanization, stream channelization, dams, wetland loss, and water withdrawals for irrigation. All of these factors were identified when SONCC coho salmon were listed as threatened under the ESA, and they all continue to affect this ESU. However, efforts to improve SONCC coho salmon critical habitat have been widespread and are expected to benefit the ESU. Within the SONCC recovery domain, from 2000 to 2006, the following improvements were

completed: 242 stream miles have been treated; 31 stream miles of instream habitat were stabilized; 41 cubic feet per second of water has been returned for instream flow; and thousands of acres of upland, riparian, and wetland habitat have been treated (NMFS 2007). Therefore, the condition of SONCC coho salmon critical habitat is likely improved or trending toward improvement compared to when it was designated in 1999.

d. Summary

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

V. ENVIRONMENTAL BASELINE

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

The evaluation in the *Environmental Baseline* of the current extinction risk of each population of each listed species within the Redwood Creek Basin, and the condition and utilization of critical habitat for each species provides a reference condition at the Redwood Creek population scale to which NMFS will later add the effects of the proposed action in the *Integration and Synthesis* section of the Opinion to determine if the action is expected to affect the population’s risk of extinction.

In addition, the effects of all past and present activities that will affect individual listed fish or the essential features of critical habitat are carried forward through the five-year period of analysis for this action to form the context or baseline to which we add the expected effects of the proposed action.

This *Environmental Baseline* section first presents information on the distribution, diversity, population abundance and population trends of the three listed salmonid species within the Redwood Creek basin which are used to evaluate the extinction risk of each listed salmonid species. Next, the general setting and location of the action area are described under *Current Watershed Condition*. Third, a description of the historic and current impacts to watershed conditions that continue to shape salmonid populations and their designated critical habitats within the action area of Redwood Creek is provided. Finally, the conservation value of designated critical habitat within the action area is described. This information is used to

describe the species' likelihood of survival and recovery, and the role that the action area plays in the overall conservation of the species and their designated critical habitats.

A. Salmonid Distribution, Diversity, Trends and Abundance in Redwood Creek

1. Salmonid Distribution

SONCC coho salmon, CC Chinook salmon, and NC steelhead all migrate through Redwood Creek, spawning and rearing in the tributaries and upper reaches as well as utilizing the mainstem. Redwood Creek basin has a steep valley with many tributaries inaccessible or unsuitable to salmonids due to the steep gradients. Often only the lower section of tributaries is utilized by salmonids.

Coho salmon distribution in the Redwood Creek basin is limited to the mainstem and the larger low gradient tributaries – primarily in Prairie Creek and its tributaries, possibly owing to the lower gradient and more pristine nature of that watershed (Anderson and Brown 1983). The RNSP conducted general stream surveys of the basin in 1980 and 1981 to describe and characterize the salmonid rearing habitat and distribution of juvenile salmonids (Anderson 1988, Brown 1988). Based on these data, RNSP estimated that coho can be found occupying 26 miles of stream within the lower Redwood Creek Basin (RNSP 2002).

Chinook salmon spawn in upper, middle, and lower Redwood Creek mainstem, Redwood Creek tributaries, and Prairie Creek and its tributaries, during November to January. Mainstem Redwood Creek may be where the majority of spawning occurs (Cannata *et al.* 2006). Juvenile Chinook salmon in Redwood Creek do not spend time rearing in upstream areas (Anderson and Brown 1983), but instead migrate downstream in spring to rear in the Redwood Creek estuary before entering the ocean in the late summer.

Steelhead are found in most small, high gradient tributaries to Redwood Creek and have the largest distribution. The majority of juvenile steelhead in Redwood Creek spend their second year of life rearing in the estuary and lower part of Redwood Creek (Anderson 1988).

Table 1 in the *Proposed Action* lists the burn units within 300 feet of perennial streams. These streams include Coyote Creek, Copper Creek, and the mainstem of Redwood Creek. All three species are present within the mainstem Redwood Creek. Coyote Creek and Copper Creek have only winter steelhead present in the lower sections near the confluence with Redwood Creek. However Coyote Creek is included within the historic range of coho salmon (Anderson 1988; Brown 1988; Neillands 1990; CDFG 2001 surveys; and RNSP unpublished data). Even though presence/absence surveys have been completed only at the mouth of Copper Creek, NMFS will assume presence of steelhead only in the lower half mile of the watershed due to slope limitations upstream. Only Redwood Creek and Copper Creek are within 150 feet of a burn unit.

2. Redwood Creek Coho Salmon Population Abundance, Diversity and Trends

a. Diversity

Redwood Creek is one of the few places in California with documented variation in the period of freshwater juvenile coho salmon rearing. Coho salmon are generally thought to rear for one year in northern California streams; a two-year rearing period had only been observed farther north (Bell and Duffy 2007). However, Bell and Duffy (2007) showed 28% of outmigrants from Prairie Creek had lived in freshwater for two years. This variation in the length of the freshwater rearing period could be critical to persistence of coho salmon in the Redwood Creek basin, because it could bolster otherwise poor performance of a particular year class, thus adding resiliency to the population.

While Prairie Creek provides a valuable diversity component to the Redwood Creek population, coho salmon are largely absent elsewhere in the basin, most likely due to habitat degradation and high water temperatures in mainstem Redwood Creek (Madej *et al.* 2006). For example, during the summer of 2003, RNSP conducted a juvenile coho salmon presence-absence snorkel survey of the lower half of mainstem Redwood Creek. During this survey, no coho salmon were observed in the main channel above river mile 13. A small number of juvenile coho salmon were observed in 9 locations in the lower 13 miles of Redwood Creek (Ozaki and Anderson 2005). This indicates that spatial structure and diversity are impaired compared to historic conditions.

Williams *et al.* (2008) determined 4,900 spawners were needed each year to be at low risk of loss of spatial structure and diversity. As the current number of spawners is a very small fraction of this number, it is likely that the Redwood Creek coho salmon population is at high risk of loss of spatial structure and diversity.

The more restricted and fragmented the distribution of individuals within a population, and the more spatial distribution and habitat access diverge from historical conditions, the greater the extinction risk. Williams *et al.* (2008) determined that at least 32 coho salmon per-IP km of habitat are needed (4,900 spawners total) to approximate the historical distribution of Redwood Creek coho salmon and habitat. The current distribution of spawning adults is almost entirely limited to the Prairie Creek subwatershed. Recent juvenile outmigrant data from Sparkman (2007) suggests that only a few adult coho salmon are returning to mainstem Redwood Creek each year to spawn. The Redwood Creek coho salmon population is at high risk of extinction due to its spatial structure and diversity being very limited compared to historical conditions.

b. Population Size and Productivity

If a spawning population is too small, the survival and production of eggs or offspring may suffer because it may be difficult for spawners to find mates, or predation pressure may be too great. This situation accelerates a decline toward extinction. Williams *et al.* (2008) determined at least 151 coho salmon must spawn in the Redwood Creek basin each year to avoid such effects of extremely low population sizes.

For the past nine years, CDFG has trapped outmigrants in Redwood Creek to provide information on the current viability of salmonid populations in the watershed. The outmigrant trapping (Sparkman 2006) documented the low numbers of coho salmon in Redwood Creek, by trapping juveniles at an upper trap located at river mile 33 and again at a lower trap located at

river mile 4, just upstream of where Prairie Creek enters mainstem Redwood Creek. From 2000 to 2006, no out-migrating coho salmon were captured at the upper trap, suggesting that for 7 years, coho salmon had not successfully spawned in the middle to upper portion of Redwood Creek (Sparkman 2006). However, in 2007, for the first time in eight consecutive years, 6 young of the year (YOY) coho salmon were caught at the upper trap (Sparkman 2007). Low numbers of juvenile coho salmon have been captured at the lower trap during all of the eight study years. For example, in 2003, 110 YOY and 12 age-1+ were captured at the lower trap, and in 2004, 202 YOY and 69 age-1+ juvenile coho salmon were captured at the lower trap (Sparkman 2004).

Documented escapement numbers of adult coho salmon in Prairie Creek in recent years indicate low numbers of returning adult coho salmon (RNSP 2006). From the years 1998 to 2004, the number of spawners and carcasses in Prairie Creek was estimated from counts in Prairie Creek, Boyes Creek, and Streelaw Creek combined. Numbers of live fish ranged from fewer than 60 in 1998-1999, to 660 in 2001-2002 (Duffy 2007). RNSP has been conducting spawning adult and carcass counts of coho salmon in Lost Man Creek since 1999, which range from a high of 46 live spawning adults and 11 carcasses in 2001-2002, to a low of 1 live spawning adult and 3 carcasses in 1999-2000. Although there may be higher numbers of spawners in Prairie Creek, all of the available information suggests that the overall number of coho salmon in the Redwood Creek basin is extremely low compared to historic conditions.

The population growth rate in Redwood Creek has not been quantified, although information from Sparkman (2007) suggests negative trends in population growth rate, as does the apparent long-term declines of coho salmon observed in Redwood Creek. Therefore, the Redwood Creek coho salmon population is at high risk of extinction given its very low population size and negative population growth rate.

3. Redwood Creek Chinook Salmon Population Abundance, Diversity, and Trends

a. Diversity

Adult Chinook salmon depend on the breaching of the bar at the mouth of Redwood Creek to enter the creek and begin migration towards spawning grounds. Most of the Chinook salmon found within the Redwood Creek basin begin their upstream migration around November, if access through the estuary is possible, and have spawned and died by January. Staff at RNSP observed adult spring-run Chinook salmon in only one season since summer steelhead surveys began in 1981.

Most Chinook salmon outmigrate during their first year during April to May, but some are known to outmigrate in the late fall, or overwinter and outmigrate the following spring. The larger the smolts are when they enter the ocean, the better chance of survival they have. Juveniles often utilize the estuary for rearing prior to the bar formation, however if they do not enter the ocean before the estuary closes off between July and September, the smolts only stand a 7-15 percent rate of survival. RNSP research shows that juvenile Chinook salmon will spend an extended period (up to late summer) rearing in the estuary before entering the ocean.

b. Population Size and Productivity

Estimates of the historical abundance of Redwood Creek Chinook salmon range from 5,000 (CDFG 1965, Good *et al.* 2005) to 1,000 (Wahle and Pearson 1987). These are estimates based on professional opinion and evaluation of habitat conditions, not on rigorous field sampling (Good *et al.* 2005). They are presented here as a conditional basis for comparison with more recent abundance estimates.

Turbid conditions and difficult access have prevented consistent, widespread sampling efforts to determine spawner populations throughout the watershed, but sampling of Prairie Creek and two main tributaries has occurred over the past 6 years. Duffy (2007) believes that Chinook salmon have declined in Prairie Creek during the past 6-7 years of monitoring, as they have gone from 400 adults to about 10-15 over a spawning season. No reliable estimate of the current adult population size of Chinook salmon in Redwood Creek is available. Spawning survey information is presented here to give an idea of recent ranges of abundance. Existing data do not allow an assessment of population stability.

Duffy (2007) collected data from 1998-2004 in four reaches of Prairie Creek, as well as the Prairie Creek tributaries Boyes Creek and Streelaw Creek. The highest number of live adult Chinook salmon observed in Prairie Creek in any of those years was 531 in 2001-2002, and in the same season 257 carcasses were counted (Duffy 2007). The lowest among those six seasons was in 2002-2003, in which 106 live adult Chinook salmon and 195 carcasses were counted.

CDFG has trapped outmigrants leaving upper Redwood Creek in spring to summer since March 2000, using rotary screw traps placed in upper and lower Redwood Creek (Sparkman 2005). Sparkman (2005, 2006) found a declining trend in populations of 0+ and 1+ Chinook salmon over the past several years from the upper and lower traps in Redwood Creek. Sparkman (2006) found a 95.8 percent reduction in catch of YOY Chinook salmon in the trap in 2006 from the previous 6-year average. The low number (987) of Chinook salmon emigrating in 2003 indicated a year class failure, and 84 percent of the variation in population emigration over the 5-year period was explained by high winter flows during the egg incubation period (Sparkman 2005a).

Redwood Creek Chinook salmon are declining precipitously, based on seine net counts during every summer between 1997 and 2006 (Anderson 2006). Bjorkstedt *et al.* (2005) has determined that the population of Redwood Creek Chinook salmon is Functionally Independent, which implies that the population is not dependent upon outside sources, and is important to the recovery of the CC Chinook salmon ESU.

4. Redwood Creek NC Steelhead Population Abundance, Diversity, and Trends

a. Diversity

Both a winter run and summer run of steelhead exist in Redwood Creek. Winter-run steelhead numbers are higher than summer steelhead numbers and summer steelhead are considered to be the salmonid most at risk of being extirpated in Redwood Creek. Winter run spawners are the last of the anadromous salmonid species to return to freshwater in the annual cycle, generally between January and April.

Juvenile steelhead can display diverse life history strategies. Some may residualize in the lower creek or estuary for several months, or even another year before they go to the ocean (Anderson 1998). Anderson (1998) found through many years of sampling that after the estuary mouth closed, numbers of juvenile steelhead decline, likely due to mortality of juveniles while trapped in the inhospitable estuary.

b. Population Size and Productivity

CDFG (1965, Good *et al.* 2005) estimated that the number of steelhead in Redwood Creek was 10,000 individuals. Both of these estimates were derived from data on other streams, and were meant to be used as only a general magnitude of runs. Steelhead have likely decreased in numbers from historical abundances (Cannata *et al.* 2006).

The most recent population estimates from CDFG's outmigrant trapping study in Redwood Creek are from the 2006 outmigration data from the upper trap (Sparkman 2007). Each season, CDFG found that large numbers of YOY steelhead emigrated from upper Redwood Creek, as evidenced by total annual trap catches ranging from 55,126 to 128,885 individuals over 6 years (Sparkman 2005). Sparkman (2006) described that between the years 2000 and 2006, there has been a negative trend in juvenile smolt production. The 2006 sampling effort saw reductions in all age classes over the last 6 years, and less fish in all age classes compared to those trapped in 2005 (Sparkman 2006).

Summer steelhead have declined significantly from historical levels in Redwood Creek. Native Americans used to depend on the harvest of summer steelhead for subsistence (Moyle *et al.* 1995, Cannata *et al.* 2006). Gerstung (2001), Cannata *et al.* 2006) extolled the abundance of summer steelhead as 10 to 25 in every pool, some of which were 20 feet deep. Summer steelhead surveys began in RNSP in 1981 in mainstem Redwood Creek, and survey data have indicated a decline since that time (Anderson 2005). No other streams in the Redwood Creek basin within RNSP have been surveyed for summer steelhead, as the smaller streams do not have pools large enough to support fish during the warm summer months. Over the course of 14 years, 0-44 adult summer steelhead were observed during surveys in a 16-mile index reach of mainstem Redwood Creek (Anderson 2005). Snorkel surveys have not been conducted in the same reach every year, which may explain some of the variability. Data suggests that summer run populations number fewer than 30 fish and is at a high risk of extinction (Spence *et al.* 2008). The loss of the summer run would result in a significant loss of diversity.

Factors that limit the number of adult summer steelhead in Redwood Creek include: (1) access to Redwood Creek if the sand berm blocks the mouth in late June, July, and August; (2) high summer water temperatures; (3) few deep holding pools (Sparkman 2006); and (4) humans displacing them when they swim in deep pools, causing steelhead to use energy reserves and to

possibly be exposed to less than optimal habitat (RNSP 2006). The 1964 flood caused excessive sedimentation, creating a widespread decrease in deep pools, and this has had a negative effect on summer steelhead such that the current population's breeding size may not be enough to sustain a viable population (Meffe 1986, Cannata *et al.* 2006). A catch and release fishery for NC steelhead remains popular in Redwood Creek. Taylor and Barnhart (1997) showed increasing summer steelhead angling mortality with increasing water temperature beginning at 16.1°C, 10 percent mortality at 20°C, and 35 percent mortality at 23.9°C. Any incidental angling mortality on adult fish is significant to the already small summer steelhead population and damaging to the potential for overall recovery.

Recent information about the historical population structure of NC steelhead within the DPS provides insight into the importance of the steelhead population within Redwood Creek. Bjorkstedt *et al.* (2005) classified the historical steelhead population within Redwood Creek as Functionally Independent, which implies that the population is not dependent upon outside sources, and is important to the recovery of the NC steelhead DPS.

C. Historic and Current Impacts

1. Logging and Roads

Timber harvesting is the most widespread land use in the Redwood Creek Basin. Over 85 percent of the basin upstream of RNSP has been logged, including about 30 percent which was logged between 1978-1992. About three-quarters of this recently-logged area was logged using intensive silvicultural methods which remove all, or almost all, trees from the harvest area. Substantial areas of RNSP were intensively logged prior to their inclusion in RNSP. Harvested areas remain at greater risk of increased erosion (principally through landsliding) several years after harvest. Most of the likely future erosion potential in the basin caused by human activity is associated with logging roads and skid trails, although roads constructed for other purposes also pose significant erosion potential.

Roads can be major sources of accelerated erosion (Kelsey *et al.* 1981a, Hagans and Weaver 1987, Best *et al.* 1995), depending on their location, design, and level of maintenance (Janda *et al.* 1975, Best 1984, Klein 1987). Common erosional problems associated with roads include washouts and stream diversions at stream crossings, mass wasting of unstable fills and over-steepened cutbanks, and interception of surface and subsurface water by cutbanks and inboard ditches.

About 1,200 miles of forest roads and 5,400 miles of skid trails were built within the Redwood Creek basin as of 1978 (Best 1984). About 445 miles of roads and 3,000 miles of skid trails (Steensen and Spreiter 1992) were included within present RNSP boundaries as a result of RNSP expansion in 1978. Roughly 270 miles of logging haul roads remain on RNSP lands. Recent surveys located about 1,200 sites with potential or existing erosional problems along old haul roads in RNSP (RNSP 2002). In addition, about 20 miles of state highway and county roads cross the watershed, including several miles of abandoned state highway.

Old roads in RNSP pose numerous problems because many have inadequate drainage structures and trigger landslides when they wash out (RNSP 2006). The skid roads that bulldozers used to drag logs on steep slopes (tractor yarding) became the new drainage network. These and other former practices drastically altered the topography and hydrology of the Redwood Creek basin (RNSP 2006), including the action area.

2. Watershed Restoration

The legislation expanding Redwood National Park in 1978 (PL 95-250) authorized a major watershed restoration effort. Congress directed that this work focus on minimizing erosion from past land uses, re-establishing native vegetation, and protecting aquatic and riparian resources along RNSP streams (Spreiter *et al.* 1995).

Since 1981, former log-haul roads have been the primary focus of the watershed restoration efforts within RNSP. About 175 miles of logging roads have been treated since 1978, some of these are upstream of the action area, increasing water quality for downstream reaches. The total volume of sediment excavated from roads is approximately 1,300,000 cubic yards. These reductions in risk should provide a long-term benefit to the Redwood Creek watershed conditions, by decreasing the sediment that would be deposited in stream channels in large storm events and by decreasing chronic erosional sources. Expected long-term benefits from watershed restoration to listed salmonids include deeper pools for rearing and holding, and cleaner substrates for spawning. Expected short-term impacts from watershed restoration include increased turbidity the first 2 years after implementation (Klein *et al.* 2006).

D. Conservation Value of the Designated Critical Habitat

Habitat conditions, including the condition of designated critical habitats, are degraded relative to pristine conditions. NMFS described the conservation value of the Redwood Creek basin within the CC Chinook salmon ESU and the NC steelhead DPS (69 FR 71880, December 10, 2004). Fish distribution and habitat use data compiled by NMFS biologists identified approximately 107 miles of occupied riverine and estuarine critical habitat for CC Chinook salmon and 138 miles of occupied riverine and estuarine critical habitat for NC steelhead (69 FR 71880, December 10, 2004). NMFS concluded that all occupied areas contain one or more PCEs for both CC Chinook salmon and NC steelhead. Restoration activities in the watershed, as well as protective management strategies, have contributed to positive influences on the watershed. Of the three occupied subwatersheds within Redwood Creek, two were rated as having high conservation value and one as having medium conservation value to the ESU and DPS (69 FR 71880, December 10, 2004).

The essential habitat types of juvenile rearing areas, juvenile migration corridors, areas for growth and development, and adult migration corridors and spawning areas are all present in SONCC coho salmon critical habitat in the Redwood Creek basin. These habitat types provide adequate amounts of essential features of critical habitat within the basin.

The action area is located in the middle reach of Redwood Creek approximately between River Miles 15 to 19.5. This section of the river is characterized by the highly confined and mountainous valley walls. Warmer water temperatures are located in the middle and upper reaches of Redwood Creek.

The action area is located midway between the Emerald Creek and Redwood Valley temperature monitoring sites, which have some of the highest mean daily maximum temperatures recorded between July 1st and August 31 from 1997 to 2003. The mean maximum temperature at the Emerald site equaled 22.2 ± 1.2 degrees Celsius ($^{\circ}\text{C}$). Further upstream, the mean maximum temperature at the Valley site equaled 24.6 ± 1.9 ($^{\circ}\text{C}$) (Madej *et al* 2006). Brett (1952) reported that all juvenile salmonids species preferred temperatures between 12 and 14 ($^{\circ}\text{C}$) and juveniles generally avoided stream temperatures above 15 ($^{\circ}\text{C}$). He also reported 26.0 ($^{\circ}\text{C}$) as the upper lethal temperature. McGreer *et al.* (1991) determined that juvenile coho survived at temperatures up to 23 ($^{\circ}\text{C}$), but none survived at water temperatures higher than 25.5 ($^{\circ}\text{C}$). The temperatures recorded in Redwood Creek show that a thermal barrier may limit salmonid distribution in the action area during the summer and early fall. Undoubtedly, the habitat is not preferable in the summer and early fall due to the warm water temperatures.

The action area contains adult holding and migratory habitat for all three salmonid species as well as spawning habitat for adult Chinook and potential rearing for juvenile coho and steelhead. However, warmer temperatures may limit adult holding and juvenile rearing. Holding and rearing likely only occur in deep pools and at the mouths of cooler tributaries, providing some refuge from the warmer temperatures of the mainstem Redwood Creek.

Copper Creek's lowest reach has good riparian cover which keeps the water temperature low, and a small amount of riffles with a variety of gravel sizes, a few small pools for rearing, and instream cover provided by boulders and bedrock that provides protection for both adult and juvenile fish. There is no LWD (RNSP 2009) because the whole watershed was clearcut in the early 1970s.

E. Environmental Baseline Summary

A reduction in habitat complexity due to channel aggradation, with decreases in pool depth, size and quantity, and leading to warmer temperatures has resulted in a reduction of adult holding and juvenile rearing habitat. Based upon the relationships between habitat quality and the health of salmonid populations, NMFS expects the population numbers of ESA-listed anadromous salmonids to remain depressed in the foreseeable future relative to historic estimates. However, improvements in habitat and salmonid populations may develop more rapidly within the RNSP portion of Redwood Creek due to road removal and road drainage improvements that will reduce sediment inputs to the creek. These sediment reduction efforts will also eventually reduce the amount of sediment that is routed through lower Redwood Creek, but this will take many years to occur. In addition, improvements in upstream habitat conditions are expected to occur on lands in the upper Redwood Creek basin owned by Green Diamond Resource Company (GDRC), as the Incidental Take Permit for the GDRC Habitat Conservation Plan was issued in 2007.

VI. Effects

In this section of the Opinion, as required by the ESA and its implementing regulations (50 CFR 402), NMFS assesses the direct and indirect effects of the proposed action, and any interrelated and interdependent actions on SONCC coho salmon, CC Chinook salmon, NC steelhead and their designated critical habitats.

A. Assessment Approach

Pursuant to ESA section 7(a)(2), Federal agencies are directed to ensure that any federal action is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. To evaluate whether an action is likely to result in jeopardy to a listed species or result in the destruction or adverse modification of designated critical habitat, NMFS considers the combination of the status of the species and critical habitat, effects of the action, and cumulative effects. An action that is not likely to jeopardize the continued existence of the listed species is one that is not likely to appreciably reduce the likelihood of both the survival and recovery of the species in the wild by reducing its numbers, reproduction, or distribution (50 CFR § 402.02). This Opinion does not rely on the regulatory definition of “destruction or adverse modification” of critical habitat at 50 CFR § 402.02. Instead, the statutory provisions of the ESA are relied upon with respect to critical habitat.

NMFS uses a conceptual model of the species and its critical habitat to evaluate the impact of proposed actions. The guiding principle behind this conceptual model is that the likelihood of survival and recovery of a species is dependent on the likelihood of survival and recovery of populations, and diversity strata, in the species. And, the likelihood of survival and recovery of each population unit is dependent upon the fitness, or reproductive success, of the individuals that comprise each population.

Predicting the effects on a population and a species requires an understanding of the condition of the population and species in terms of their chances of surviving and recovering. To do this, the probability of recovery is determined, given their condition and threat regime during the period of impact. Viability is the state in which extinction risk of a population is negligible over 100 years and full evolutionary potential is retained (McElhany *et al.* 2000). A viable population (or species) is one that has achieved the demographic parameters needed to be at low risk of extinction. The risk of extinction of the species is equated with the “likelihood of both the survival and recovery of the species in the wild” for purposes of conducting jeopardy analyses under section 7(a)(2) of the ESA. The jeopardy analysis, therefore, focuses on whether a proposed action appreciably increases extinction risk, which is a surrogate for appreciable reductions in the likelihood of survival and recovery.

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

the populations' likelihood of survival and recovery would be expected to reduce the likelihood of survival and recovery of the species at the ESU or DPS level.

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

Jeopardy Analysis

Analysis of "jeopardy" is conducted in a series of steps. First, available information is examined to identify direct and indirect physical, chemical, and biotic effects of the proposed actions on individual members of listed species or aspects of the species' environment in the action area. Available information is evaluated to identify the probable response of individuals of a species, including behavioral responses. These responses are then assessed to determine if they can reasonably be expected to reduce a species' reproduction, numbers, distribution, or diversity. Lastly, the results are considered in assessing whether any reductions would reasonably be expected to appreciably reduce a species' likelihood of surviving and recovering in the wild.

Adverse Modification Analysis

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

B. Insignificant or Discountable Effects

Many of the proposed actions are expected to have insignificant or discountable effects due to their distance from water courses or benign activities. Thinning for the five fuel breaks, grass mowing around the seven historic structures, and placement of the holding tanks will have insignificant effects on listed salmonids and their habitats because these activities occur at least

300 feet of any perennial stream. The grass mowing and brush clearing around the four water source ponds will have negligible effects on salmonids and their habitats because the ponds are located near ridge tops, well up slope from any anadromous reach of any streams. The two old growth prescribed burn units and the coastal grasslands unit at Boyes Prairie are more than 300 feet from any perennial stream and there are no intermittent streams within 100 feet of either unit. Also, these units are located on flat ground and there is little possibility for ash and sediment transport to any stream. Therefore, NMFS believes the effects for burning these old growth units and coastal grassland units will be discountable to listed salmonids and their designated critical habitats.

1. Increased Water Temperatures

Stream temperatures also often increase after fire occurs. Usually the temperature increase is due to the removal of overhead protective vegetation, instead of the direct heat flux from the fire. Elevated stream temperatures are detrimental to most cold water fish species. Protection of the streamside vegetation, and quick revegetation of burned areas, is critical to stream rehabilitation.

Wildcat prescribed burn unit is the only unit with thick canopy cover in the riparian zone. Because 100% of the canopy cover is expected to be maintained, NMFS believes that water temperatures will not be elevated as a result of the proposed action.

2. Introduction of Petroleum Products

Most activities covered under the Fire Management Plan require the use of equipment, such as chain saws powered by diesel fuel and lubricated by other petroleum products that are potentially hazardous to listed salmonids. With the use of this equipment, there is potential for spill of hazardous compounds near the stream. The risk of potential chemical pollution is significantly higher near streams because of the proximity of sensitive aquatic species and because of the role of water in transporting contaminants to sensitive receptors.

Since the proposed action does not place restrictions on where fueling may occur, NMFS expects some fuel may be inadvertently leaked near the stream, within a distance transportable via runoff. NMFS does not expect that the quantity of leaked material will lead to adverse effects to salmonids since any leaked fuel and oil would be limited and isolated, and would be consumed by fire in a prescribed burn. In the rare event that these substances would reach the stream via storms, they would then be diluted in the storm flows and have a very low likelihood of adversely affecting salmonids. We expect very low pollution levels in these storm flows given the relatively undeveloped nature of the watershed above the action area. Thus, we do not expect any adverse effects to salmonids as a result of chemical contamination.

3. Decreases in Future Large Woody Debris Input

The proposed burning and thinning may remove up to 18 inch DBH conifer trees. The removal of trees at any age sets back the succession of large trees with the potential to fall into the stream channel, providing large woody debris (LWD). Overhanging vegetation, floodplain vegetation, and vegetation that is recruited directly into the channel provide important cover for salmonids. Vegetative structure increases hydraulic boundary roughness resulting in relatively lower

velocities near the flow-substrate interface (Beschta and Platts 1986), and increases channel and habitat stability (Lisle 1986). Many salmonids seek out low velocity areas close to high velocity areas in order to optimize foraging and maximize net energy gain (Fausch 1984). Riparian vegetation also provides terrestrial subsidies to the aquatic environment and is a source for insitu LWD and other complex habitat elements. These essential habitat functions enable juvenile salmonids to hide from predators and endure high flows that may displace them, including towards the ocean prematurely. Refuge from high, turbid flows is essential for salmonid survival (Moyle *et al* 2008).

Because no shading riparian vegetation will be removed during fire line construction and existing canopy cover will be maintained along all riparian areas within 300 feet of any intermittent or perennial stream, NMFS does not expect any reduction to LWD recruitment into Redwood Creek and its tributaries.

C. Effects

1. Increased Turbidity and Sedimentation

The literature is replete with evidence of fire-induced changes in water quality, including increased sedimentation and turbidity, increased stream temperatures, and increased concentrations of nutrients resulting from surface runoff (Buckhouse and Gifford 1976, DeByle and Packer 1972, Feller and Kimmins 1984, Helvey *et al.* 1985, Nissley *et al.* 1980, Richter and Ralston 1982, Striffler and Mogren 1971, Tiedemann *et al.* 1979, Wright *et al.* 1976). Wild and prescribed fires on forestlands have the potential to decrease on and off site water quality. Effects may be short or long-lived. A carefully controlled study on a larch (*Larix occidentalis*), Douglas fir (*Pseudotsuga menziesii*), and Engelmann spruce (*Picea engelmannii*) site in western Montana (DeByle and Packer 1972) found that sediment returned to preburn levels after about four years.

Erosion will be reduced through several protection measures described under the Proposed Action. The replacement of topsoil on fire lines after burns will reduce erosion and sediment delivery to streams. The installation of waterbars within 300 feet of streams will direct overland flow away from the exposed soil on fire lines and reduce erosion. The burning of debris piles at least 300 feet of any stream will leave soils nearest the streams intact, reducing erosion potential.

Erosion will be reduced as a result of protection measures, however adverse effects are expected to occur as a result of turbidity and sedimentation in the burn units that are within 150 feet of perennial fish bearing streams. Pig Pen and Wildcat burn units are the only two units within this proximity of anadromous reaches.

a. Pig Pen Unit

The unit is small (69 acres) and a 50 foot wide strip of riparian shrubs and red alders exist between the unit and Redwood Creek. Prescribed burns within this unit have historically been very spotty with significant portions of the unit not igniting due to the high fuel moistures and

significant shading caused by the surrounding old growth redwood forest (Arguello 2008). In addition, this unit is composed entirely of grass and small shrubs that result in a small amount of biomass that will actually burn. And, like other grassland sites, the vegetation will rapidly regrow (i.e. within the first few weeks after initial rains), rapidly increasing site stability and further preventing ash transportation. Due to these compounding negating factors, only a small amount of ash and sediment is expected to enter Redwood Creek, even with its close proximity to the unit. The Pig Pen unit parallels Redwood Creek for approximately a half mile. Adverse effects would occur along this section of Redwood Creek. This adverse effect would be short term; primarily right after the first major rainstorm of the first post burn season, which should be approximately in November or December.

The life stages present at that time of the year (September through December) in Redwood Creek near the Pig Pen unit would be migrating adult Chinook and coho salmon, rearing juvenile coho salmon and steelhead trout, as well as incubating Chinook salmon eggs. Due to the high volume of water flowing through Redwood Creek at that time of year, any ash and sediment that does reach the stream should be rapidly diluted and so any adverse effects should be very localized to immediately adjacent to the unit. Adult Chinook salmon and coho salmon as well as rearing juvenile salmon and steelhead trout may be affected by the increased turbidity, however the localized adverse effect should rapidly dissipate over a matter of days if not hours. Adverse effects include increased turbidity, gill abrasion, suffocation of incubating eggs, and possibly a slight change in the water acidity. Because of the reduced water quality and disturbance, salmonids may have reduced feeding success and relocate or be displaced to other less desirable habitats. NMFS does not expect the adverse effects to rise to the level of death to individuals. Chinook salmon eggs will not be affected by the increased sedimentation.

b. Wildcat Unit

The Wildcat unit at 1,054 acres, encompasses the majority of the Copper Creek basin and is within 150 feet of the anadromous reach of Copper Creek and Redwood Creek. The Wildcat unit, Copper Creek unit, and Childs Hill unit all are within the Copper Creek basin and total 1,763 acres of contiguous burn area. The Copper Creek and Childs Hill units cover primarily grassland ecotypes in the upper third of the drainage. Wildcat unit is composed of second growth coniferous forest and grasslands. Wildcat will be burned in the same season after the Copper Creek and Childs Hill units. The burn prescription is for a “cool” under burn that will only consume small diameter woody ground fuels, small pole sized trees, herbaceous vegetation, and duff. Within the forested sections, canopy should not change significantly from its existing level of almost 100%. Copper Creek runs through the middle of the Wildcat unit. Riparian shading is not expected to change, as the forest canopy will not alter significantly. The intact forest canopy will also greatly reduce the impact force of falling rain which should decrease the amount of mobilized ash and sediment.

The grassland sections of the unit will be devoid of vegetation immediately following the burn in September or October. The lack of vegetation, coupled with the steep slopes and underburn of the adjacent forest, may result in overland flow carrying ash and sediment during the rains. The majority of the ash and sediment that is transported should be prevented from entering the stream by the remaining larger woody debris and riparian vegetation that will not be consumed by the

fire. The fire is expected to be spotty (Young 2009), with many unburned areas remaining, which should act as ash and sediment traps. In particular, it is likely that the damper riparian areas near the perennial sections of the stream will not burn at all due to high fuel moisture content (Young 2009). These unburned riparian areas will also act as ash and sediment traps. Some ash and sediment, however, is expected to reach the stream.

Studies on adult and juvenile salmon have shown that salmon, when exposed to short-term pulses of suspended sediments, dispersed from or avoided the area (Bisson and Bilby 1982, Whitman *et al.* 1982, Berg and Northcote 1985). Large increases in suspended sediments, usually measured as turbidity, may damage sensitive gill membranes in juvenile salmon or affect their ability to perform vital functions. Cedarholm and Reid (1987) observed evidence of stress in juvenile coho salmon exposed to suspended sediment levels from 1,000 to 12,000 mg/L. Temporary visual impairment, caused by the suspended sediments, reduced the salmon's ability to capture prey (Berg 1982). Redding *et al.* (1987) reported physiological changes indicative of stress in coho salmon and steelhead exposed to sublethal levels of suspended sediments.

Similar to the discussion previously, the majority of adverse effects should be short term, potentially lasting only a day or two during the first large flows and decreasing thereafter. However, different from the Pig Pen burn, the intensity of effects in Copper Creek is expected to be greater due to a much larger burn area, steeper slopes, and a smaller watercourse that is being affected. There is much less opportunity for dilution of sediment and ash in Copper Creek than there is in Redwood Creek.

The listed salmonid life stage present in Copper Creek between September and December is rearing juvenile steelhead trout. Steelhead is assumed to occupy only the lower half mile of Copper Creek. Redwood Creek will contain migrating adult Chinook and coho salmon and rearing juvenile coho salmon and steelhead trout. Additionally, the incubating eggs of Chinook salmon may be found in the mainstem of Redwood Creek. NMFS expects adverse effects to juvenile steelhead that are rearing in the lower section of Copper Creek. Adverse effects related to increased turbidity and sedimentation include gill abrasion, and possibly a slight change in the water acidity. Because of the reduced water quality and disturbance, juvenile steelhead are expected to have reduced feeding success and relocate or be displaced to other less desirable habitats such as the mainstem of Redwood Creek. Tributaries such as Copper Creek provide good high flow and temperature refugia for rearing steelhead. If juvenile steelhead are displaced into Redwood Creek, particularly during high flows, they may suffer from increased energy expenditure and even get washed downstream. NMFS expects some juvenile steelhead will die as a result of poor water quality and displacement to less desirable habitats.

Additionally, the increases in sediment into Copper Creek will fill pools and simplify habitats, which will adversely affect juvenile NC steelhead. The filling of pools reduces the quality of rearing habitat by reducing the available deeper water refugia. The steelhead spawning habitat is compromised with increases in sedimentation leading to greater embeddedness. When spawning gravel is embedded, the increased amount of fines reduces the suitability and success of redds as eggs may suffocate and emergence is difficult. Adult steelhead are expected to enter Copper Creek and spawn after the first rains when the majority of the sediment plume has passed.

NMFS does not expect there to be enough increase in fines to adversely effect steelhead eggs deposited after the plume or impede the emergence of steelhead fry.

An increase in sedimentation and turbidity downstream of the confluence is still expected to result from the burn in the Copper Creek basin. However, due to the larger volume of water flowing in Redwood Creek and the higher background turbidity rates, effects of the burn will be muted and less intense in Redwood Creek. The increase in fines may suffocate Chinook eggs and make emergence difficult. Additionally, some adult and juvenile steelhead, coho and Chinook salmon may be temporarily displaced while trying to avoid the sediment plume.

NMFS expects the majority of effects related to suspended sediment to dissipate quickly following the first rains, however, effects related to embeddedness and habitat simplification will remain for a longer period of time. It may take several seasons of flushing flows to return the habitat to the pre-project conditions.

E. Interrelated and Interdependent Actions

Based upon the information provided in the 2010 RNSP Fire Management BA, NMFS does not anticipate interrelated or interdependent actions.

VII. CUMULATIVE EFFECTS

Cumulative effects as defined in 50 CFR §402.02 are those effects of future State or private activities not involving Federal activities that are reasonably certain to occur within the action area considered in this Opinion. 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.

In general, NMFS believes that conditions and activities occurring on non-Federal lands within the Redwood Creek basin will exert a greater influence on SONCC coho salmon, CC Chinook salmon, and NC steelhead habitat than will those actions occurring on Federal lands. The upper 60 percent of the Redwood Creek basin is in private ownership. Recovery of SONCC coho salmon, CC Chinook salmon, and NC steelhead habitat on non-Federal lands remains unlikely without changes in forestry, agricultural, and other practices within non-Federal riparian areas.

Under the current California Forest Practice Rules (FPRs), logging haul roads are likely to remain a significant source of sediment during future large storms because the FPRs cease to apply once logging has been completed and the logged area has met conifer stocking requirements. The current maintenance period for roads and erosion-control structures is based primarily on the time required to complete the harvest operation. Typically, road maintenance is required for a period of 2 to 4 years: 1 to 3 years during the harvest operation plus 1 year following harvest for stocking. As a result, long-term maintenance of roads, culverts and erosion-control structures has been rare. Unless planned road abandonment and construction of temporary roads (that is, the intentional construction of roads that will be treated to reduce

erosion after timber harvests are completed) are encouraged or required by the FPRs, perhaps through a more rigorous assessment of cumulative watershed impacts, roads will remain a significant source of sediment during future large storms.

Until improvements in non-Federal land management practices are actually implemented, NMFS assumes that future private and State actions will continue at similar intensities as in recent years, and that habitat for listed salmonids will continue to be degraded. Agriculture, timber harvest, road building, and livestock grazing have resulted in loss of riparian vegetation, migration barriers, increased water temperatures, increased nutrient loading, loss of pool habitat, and increased fine sediment. In the past, these impacts have substantially reduced survival of listed salmonids in Redwood Creek.

VIII. INTEGRATION AND SYNTHESIS OF THE EFFECTS ON THE LISTED SALMONID SPECIES AND THEIR CRITICAL HABITAT

In this section, we integrate and synthesize the effects of the proposed action combined with the interrelated and interdependent actions, the environmental baseline, and cumulative effects, and the status of the species. During the integration and synthesis, we consider the aggregate of effects to individual salmonids and any resulting effects on the populations of the three salmonid species and designated critical habitats. The expected response of salmonid populations is determined by assessing any potential reductions in the numbers, reproduction, or distribution of listed salmonid populations in the action area. We then determine whether any reductions in numbers, reproduction or distribution will appreciably reduce the likelihood of both the survival and recovery of listed salmonids. These final steps take into account the status and trends of the population or ESU in question, the factors currently and cumulatively affecting them, and the role the affected population likely plays in the ESU

A. Effects on SONCC Coho Salmon, CC Chinook Salmon, and NC Steelhead

The proposed action will result in adverse effects to adult Chinook salmon, adult coho salmon, and rearing juvenile coho salmon and steelhead in the action area. Since coho salmon utilize freshwater habitat for more than one year and juvenile steelhead are present year-round in the action area, coho salmon and steelhead are exposed to changes in habitat conditions for a longer period of time. Our effects analysis suggests that the minimization measures in the proposed action are sufficient to maintain habitat in the existing state, or may result in slight, short-term decreases in habitat quality and quantity. Given the use and distribution of coho salmon, Chinook salmon, and steelhead in the action area, we expect that a minimum amount of negative effects to individuals would be primarily in the form of behavioral modification and respiratory distress to adults due to elevated turbidity. We also expect that juvenile coho salmon and steelhead will be affected by short-term increases in turbidity, and that negative effects to individual juvenile coho salmon and steelhead will occur due to slight changes in feeding behavior, respiration, and displacement. We expect the adverse affects to rise to the level of death to some juvenile NC steelhead in the Copper Creek basin. NMFS does not expect that the numbers of fish to be affected will reduce the ability of the population to survive and recover. In turn, we do not expect a reduction in the numbers, reproduction, or distribution of SONCC coho

salmon and CC Chinook salmon at the ESU scale, and NC steelhead at the DPS scale, that appreciably reduces their likelihood of both survival and recovery in the wild.

B. Effects on SONCC Coho Salmon, CC Chinook Salmon, and NC Steelhead Critical Habitat

Implementation of the RNSP Fire Management Plan will result in small, short-term negative effects to coho salmon, Chinook salmon, and steelhead habitat. Primarily, spawning and rearing habitat will either be maintained in the existing state, or may experience minor, short-term decreases in the quality of spawning substrate, and quality and quantity of pool habitat for rearing. Since we do not expect more than a minor, short term decline in habitat quantity or quality, the conservation value of the three listed species critical habitat will not be appreciably diminished. Therefore, NMFS has determined that implementation of the RNSP Fire Management Plan is not likely to appreciably diminish the value of designated critical habitat for the conservation of SONCC coho salmon CC Chinook salmon, and NC steelhead in the wild.

IX. CONCLUSION

After reviewing the best available scientific and commercial information, the current status of SONCC coho salmon, CC Chinook salmon, NC steelhead, and their designated critical habitats, the environmental baseline for the action area, the anticipated effects of the RNSP Fire Management Plan, and the cumulative effects, it is NMFS' biological opinion that the implementation of the RNSP Fire Management Plan, as proposed, is not likely to jeopardize the continued existence of SONCC coho salmon, CC Chinook salmon, or NC steelhead, and is not likely to destroy or adversely modify designated critical habitat of SONCC coho salmon, CC Chinook salmon or NC steelhead.

X. INCIDENTAL TAKE STATEMENT

Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by NMFS as an act which kills or injures fish or wildlife. Such an act may include significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2) of the ESA, taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the terms and conditions of this Incidental Take Statement.

The measures described below are non-discretionary, and must be undertaken by RNSP so that they become binding conditions of any grant, permit or contract issued for RNSP Fire Management Plan implementation, as appropriate, for the exemption in section 7(o)(2) to apply. RNSP has a continuing duty to regulate the activity covered by this Incidental Take Statement. If RNSP (1) fails to assume and implement the terms and conditions; or (2) fails to require contractors, grantees, or permittees to adhere to the terms and conditions of the Incidental Take Statement through enforceable terms that are added to the permit or grant document, the protective coverage of section 7(o)(2) may lapse. In order to monitor the impact of incidental take, RNSP must report the progress of the action and its impact on the species to NMFS as specified in the Incidental Take Statement [50 CFR § 402.14(i)(3)].

A. Amount or Extent of Take Anticipated

NMFS anticipates that some prescribed burning actions may result in incidental take of NC steelhead, CC Chinook and SONCC coho salmon. Juvenile NC steelhead will be injured, harmed, or killed from the increased sediment and turbidity in Copper Creek. Juvenile and adult CC Chinook and SONCC coho salmon will be injured or harmed from the increased sediment and turbidity in Redwood Creek.

NMFS cannot, with the current best available science, quantify anticipated take of individual fish associated with prescribed burning and the subsequent transport of sediment downstream because of the variability and uncertainty associated with individual responses to the effects of the Project, the varying population size of each species, annual variations in the timing of spawning, and individual habitat use in the action area. Therefore, NMFS anticipates incidental take of juvenile steelhead within the lower half mile of Copper Creek and Redwood Creek at the mouth of Copper Creek only during the first several storms of sufficient duration and intensity to mobilize and transport project-related sediment and ash to downstream anadromous salmonid habitat within Copper Creek. In addition, NMFS anticipates incidental take of CC Chinook and SONCC coho juveniles and adults, as well as NC steelhead juveniles, within a half mile of Redwood Creek adjacent to the Pig Pen unit for only one season after the Pig Pen burn.

B. Effect of the Take

In the accompanying Opinion, NMFS determined that the level of anticipated take from the RNSP Fire Management Plan is not likely to jeopardize the continued existence of SONCC coho salmon, CC Chinook salmon, or NC steelhead and is not likely to destroy or adversely modify designated critical habitat for SONCC coho salmon, CC Chinook salmon, and NC steelhead.

C. Reasonable and Prudent Measures

NMFS believes that the following reasonable and prudent measures (RPM) are necessary and appropriate to minimize take of SONCC coho salmon, CC Chinook salmon, and NC steelhead.

RNSP shall:

1. Ensure that the monitoring necessary to track changes to salmonid habitat quality and quantity in the action area is implemented.
2. Ensure that any ground cover destroyed to the level of bare soil is rehabilitated to reduce erosion.

D. Terms and Conditions

RNSP must comply with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

- RPM 1.** Ensure that the monitoring necessary to track changes to salmonid habitat quality and quantity in the action area is implemented.
- a. RNSP shall ensure that monitoring is completed prior to and after burning in the Copper Creek basin. As stated in the Biological Opinion, monitoring at the mouth of Copper Creek will track pre and post burn turbidity
 - b. RNSP shall provide monitoring reports to the NMFS Arcata office within one year after monitoring is completed.
- RPM 2.** Ensure that any ground cover within the riparian zone that is destroyed to the level of bare soil is rehabilitated to reduce erosion.
- a. RNSP shall re-seed using native seed or follow RNSP mulching guidelines in any burned area that consists of bare soil greater than one square meter in size immediately adjacent to the high flow mark of any waterway.

E. Conservation Recommendations

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

NMFS recommends RNSP use mineral or vegetable based bar oil instead of the standard petroleum based oils when lubricating chainsaw chains and bars. These environmentally friendly lubricating oils are non toxic and bio degrades quickly if spilled.

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

XI. REINITIATION OF CONSULTATION

This concludes formal consultation on the RNSP Fire Management Plan. As provided in 50 CFR § 402.16, re-initiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) the amount or extent of incidental take 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 agency action is subsequently modified in a manner that causes an effect on listed species or critical habitat not considered in this Opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount of incidental take is exceeded, formal consultation shall be reinitiated immediately.

XII. LITERATURE CITED

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MAGNUSON-STEVENSON FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT CONSERVATION RECOMMENDATIONS

I. INTRODUCTION

The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267, 16 U.S.C. 1801 *et seq.*), established new requirements for “Essential Fish Habitat” (EFH) descriptions in Federal fishery management plans and requires Federal agencies to consult with NOAA’s National Marine Fisheries Service (NMFS) on activities that may adversely affect EFH. EFH for Pacific Coast salmon has been described in Appendix A, Amendment 14 to the Pacific Coast Salmon Fishery Management Plan. The 2010 Redwood National Park Fire Management Plan and Prescribed Burning in Prairie Creek Redwoods and Jedediah Smith Redwoods State Parks in RNSP affects the Redwood Creek watershed and its tributary, Copper Creek, both of which have been designated EFH for salmon.

Only species managed under a Federal fishery management plan are covered under the MSFCMA. Coho salmon and Chinook salmon are managed under Federal fishery management plans, whereas steelhead are not managed. Therefore, these EFH Conservation Recommendations address only coho salmon and Chinook salmon and do not address steelhead.

II. LIFE HISTORY AND HABITAT REQUIREMENTS

General life history information and Evolutionarily Significant Unit (ESU) status for Southern Oregon/Northern California Coast (SONCC) coho salmon and California Coast (CC) Chinook salmon are discussed in the associated biological opinion (enclosure 1). Further detailed information on coho salmon ESUs is available in the NMFS status review for coho salmon from Washington, Oregon, and California (Weitkamp *et al.* 1995), status review update (NMFS 2001), the recent coho salmon status review done by the California Department of Fish and Game (CDFG 2002), as well as the presence and absence update for the northern California portion of the SONCC coho salmon ESU (Brownell *et al.* 1999). Detailed information on Chinook salmon ESUs is available in the NMFS status review for Chinook salmon from Washington, Idaho, Oregon, and California (Myers *et al.* 1998).

III. PROPOSED ACTION

The proposed action concerns management of RNSP land through thinning and burning treatments. The proposed action is more fully described in the associated biological opinion (enclosure 1).

IV. EFFECTS OF THE PROPOSED ACTION

Effects of the RNSP 2010 Fire Management Plan and Prescribed Burning on coho and Chinook salmon EFH are described in the *Effects of the Action* section of the associated biological opinion. In the action area, EFH is adversely affected by habitat degradation resulting from increased sedimentation.

V. CONCLUSION

After reviewing the effects of the RNSP 2010 Fire Management Plan and Prescribed Burning, NMFS has determined that the plan may adversely affect coho salmon and Chinook salmon EFH.

VI. EFH CONSERVATION RECOMMENDATIONS

Pursuant to section 305(b)(4)(A) of the MSFCMA, NMFS recommends that the term and conditions and the conservation recommendation in the biological opinion's incidental take statement be adopted as the EFH conservation recommendation for coho salmon and Chinook salmon.

VII. FEDERAL AGENCY STATUTORY REQUIREMENTS

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

Appendix 1