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

March 21, 2012

In response, refer to:
2011/06430

Mr. Patrick J. Rutten
NOAA Restoration Center
Southwest Region Supervisor
777 Sonoma Ave., Room 219-A
Santa Rosa, California 95404-6528

Ms. Jane Hicks
Chief, Regulatory Branch
U.S. Army Corps of Engineers
1455 Market Street
San Francisco, California 94103-1398

Dear Mr. Rutten and Ms. Hicks:

This letter transmits NOAA's National Marine Fisheries Service's (NMFS) final biological opinion (enclosure 1) and Essential Fish Habitat (EFH) consultation (enclosure 2) pertaining to the NOAA's Restoration Center's (RC) proposed funding and the U.S. Army Corps of Engineers (Corps) proposed permitting of restoration projects within the National Marine Fisheries Service's Northern California Office jurisdictional area (Program).

The Program is proposed to be effective from 2012 through 2022, and consists of restoration actions that will be funded by NOAA RC in Humboldt, Del Norte, Trinity, Siskiyou, and part of Mendocino counties. The Corps proposes to issue permits for these projects under section 10 of the Rivers and Harbors Act of 1899, and section 404 of the Clean Water Act. The Program will fund, permit, or both, the following restoration activities that are considered in the biological opinion: instream habitat improvements, instream barrier modification for fish passage improvement, bioengineering and riparian habitat restoration, upslope watershed restoration, removal of small dams, creation of off-channel/side-channel habitat features, development of alternative stockwater supply, tailwater collection ponds, water storage tanks, piping ditches, fish screens, headgates, and water measuring devices. Enclosure 3, "Number of sediment producing projects per Hydrologic Unit Code (HUC) 10 per year," and enclosure 4, "Sample Application and Monitoring Checklist" are also enclosed.

The enclosed biological opinion is based on NMFS' review of information provided with NOAA RC's and the Corps' February 2, 2011, request for formal consultation, a biological assessment (BA) for the Program, and several e-mails that occurred during the consultation. The biological opinion addresses potential 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 DPS of Pacific Eulachon
(*Thaleichthys pacificus*)
Threatened (75 FR 13012, March 18, 2010)

Southern Resident Killer Whales DPS
(*Orcinus orca*)
Endangered (70 FR 69903, November 18, 2005)

Southern DPS of North American Green Sturgeon
(*Acipenser medirostris*)
Threatened (71 FR 17757, April 7, 2006)
Designated critical habitat (74 FR 52300, October 9, 2009)

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

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

Northern California (NC) steelhead DPS
(*O. mykiss*)
Threatened (71 FR 834, January 5, 2006,)
Designated critical habitat (70 FR 52488, September 2, 2005)

NMFS concluded that the project, as proposed, is not likely to adversely affect southern DPS of Pacific Eulachon, southern DPS of Green Sturgeon, or Southern Resident Killer Whales; or designated critical habitat for Southern eulachon, or Southern Green Sturgeon. 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 the amount or extent of incidental take of SONCC coho salmon, CC Chinook salmon, or NC steelhead occurring as a result of the proposed action. Additionally, two discretionary conservation recommendations are 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, however, the proposed project contains adequate measures to avoid, minimize, mitigate, or otherwise offset the adverse effects to EFH. NMFS has no additional EFH conservation recommendations to provide at this time. This concludes EFH consultation for the proposed project. Pursuant to 50 CFR 600.920(l), the Corps must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH.

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

cc: Bob Pagliuco, NOAA RC, Arcata, CA
Kelly Reid, Corps, Eureka, CA
Copy to Administrative File:15422SWR2009AR00566

Enclosure 1

BIOLOGICAL OPINION

ACTION AGENCY:	NOAA Restoration Center United States Army Corps of Engineers
ACTION:	Program to fund, permit (or both), restoration projects within the NOAA Restoration Center's Northern California Office jurisdictional area
CONSULTATION CONDUCTED BY:	National Marine Fisheries Service, Southwest Region
TRACKING NUMBER:	151422SWR2009AR00566
DATE ISSUED:	**March 21, 2012**

I. CONSULTATION HISTORY

On February 2, 2011, NOAA's National Marine Fisheries Service (NMFS) received a letter from the NOAA Restoration Center (RC) requesting formal consultation pursuant to section 7(a)(2) of the Endangered Species Act (ESA), as amended (16 U.S.C. § 1531 et seq.) and its implementing regulations (50 CFR § 402). The request for consultation was in regards to a program that will fund restoration actions within the NOAA Restoration Center's Arcata Office jurisdictional area for a period of 10 years. The consultation concerns the effects of the proposed program and associated restoration activities on the Southern Oregon/Northern California Coast (SONCC) coho salmon (*Oncorhynchus kisutch*), threatened Northern California (NC) steelhead (*O. mykiss*), threatened California Coastal (CC) Chinook (*O. tshawytscha*), threatened southern Distinct Population Segment (DPS) of Pacific eulachon (*Thaleichthys pacificus*), endangered Southern Resident Killer Whales (*Orcinus orca*); and designated critical habitat for SONCC coho salmon, NC steelhead, CC Chinook, Southern eulachon, and Southern Green Sturgeon (*Acipenser medirostris*). Included with the request for consultation was a biological assessment (NOAA 2011). A subsequent letter was received on February 23, 2011, from the U.S. Army Corps of Engineers (Corps), acknowledging their participation in the program, identified NOAA RC as the lead action agency, and requested initiation of consultation.

Individuals from Southern DPS of Green Sturgeon or the Southern DPS of Pacific eulachon are not likely to be present in the action area during the implementation of habitat restoration projects (the summer low-flow period), and because projects won't be implemented in the estuary and sediment effects are minimized, effects to the Eulachon's designated critical habitat are expected to be negligible. Therefore, Southern DPS Green Sturgeon, the Southern DPS of Pacific eulachon, and their critical habitats are not likely to be adversely affected by the proposed action and will not be further considered in this biological opinion. In addition, based on the beneficial effects of restoration projects to anadromous salmonids, NMFS anticipates the proposed action will not adversely affect the Endangered Southern Resident killer whales, but is expected to have a beneficial effect on local populations of salmon, which are one of their major food sources. Because the project is not likely to adversely affect Southern Resident Killer Whales, they will not be further considered in this biological opinion.

A complete administrative record for this consultation is on file at NMFS' Northern California Office, Arcata, CA.

II. DESCRIPTION OF THE PROPOSED ACTION

The NOAA RC proposes to fund restoration projects in Humboldt, Del Norte, Trinity, Siskiyou, and a part of Mendocino counties and the Corps proposes to issue permits under section 10 of the Rivers and Harbors Act of 1899, and section 404 of the Federal Water Pollution Control Act, as amended (Clean Water Act (CWA)), for the restoration projects (figure 1) as necessary. The restoration projects will be within the NOAA RC's Northern California Office jurisdictional area and include projects funded, permitted, or both from 2012 through 2022. Proposed restoration projects are categorized as follows: instream habitat improvements, instream barrier modification for fish passage improvement, bioengineering and riparian habitat restoration, upslope watershed restoration, removal of small dams, creation of off-channel/side channel habitat features, development of alternative stockwater supply, tailwater collection ponds, water storage tanks, piping ditches, fish screens, and headgates, and water measuring devices.

NOAA RC staff in Arcata, California will administer and oversee the program to facilitate implementation of the restoration projects occurring in the Northern California Office of NOAA's National Marine Fisheries Service (Program). This biological opinion will cover projects either funded by the NOAA RC, those that receive a Corps permit under the Program, or both. All restoration projects included in the Program and covered by this biological opinion will be subject to the administration process described in Section B, *Oversight and Administration*. Restoration projects may be submitted to the Program by either the Corps or the NOAA RC. The NOAA RC will take the lead for the Program and participate in the screening of individual projects under consideration for inclusion in the Program, and will track implementation of individual projects. Such tracking will include documentation and reporting to the NMFS Northern California Office of any incidental take that results from individual projects under this Program.

A. Action Area

The action area is defined as all areas 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 includes all stream channels, riparian areas, and hydrologically linked upslope areas that will be affected by the implementation of the proposed restoration projects that are authorized under the Program. Qualifying restoration projects occurring within the NOAA RC's Northern California Office boundaries will be implemented under the Program (figure 1). Effects resulting from most restoration activities will be restricted to the immediate restoration project site, while some activities may result in turbidity for a short distance downstream. The specific extent of effects from each individual habitat restoration project will vary depending on project type, specific project methods, and site conditions.

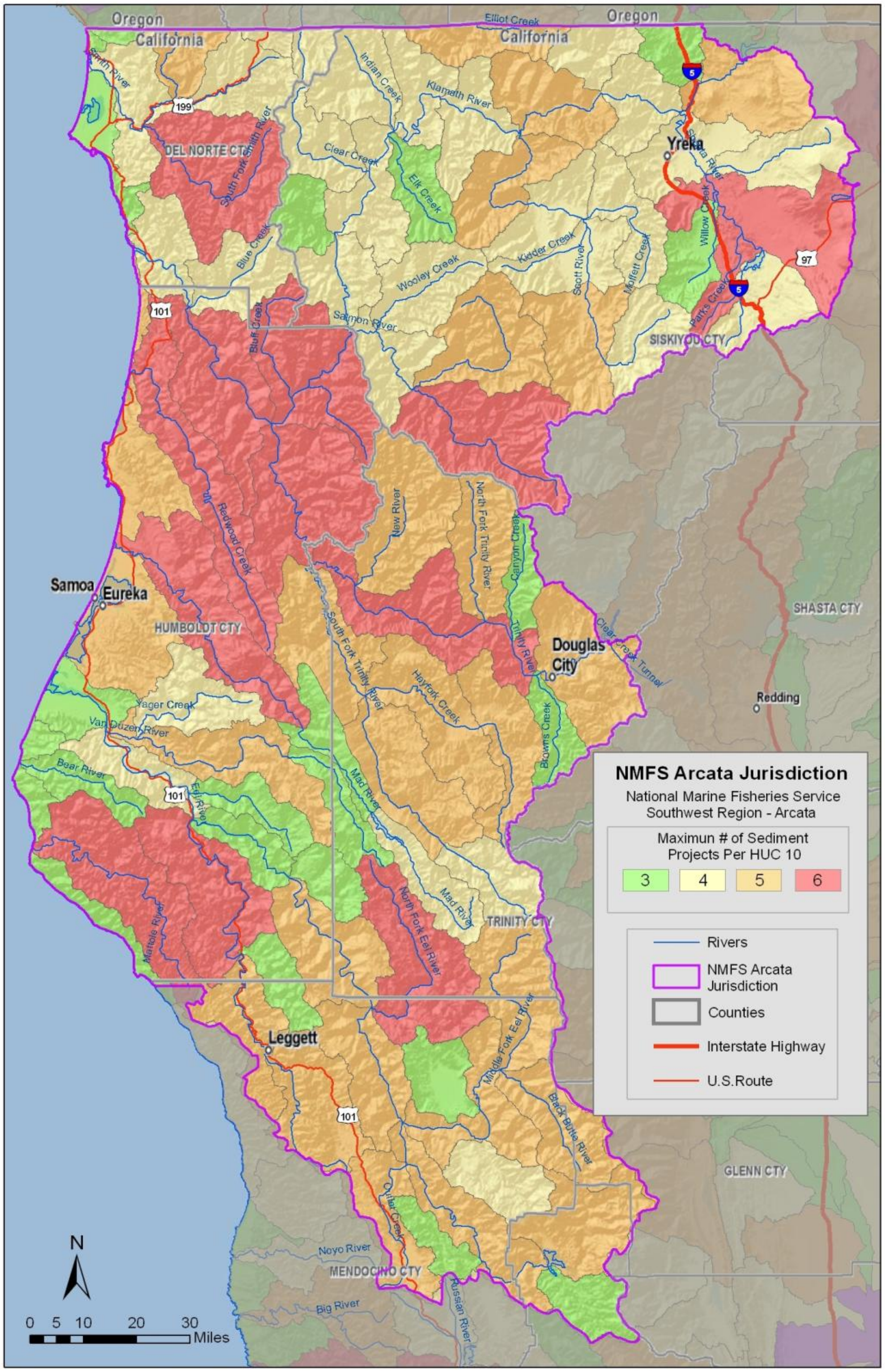

Figure 1. Map showing the action area of the proposed Program. Shaded regions indicate maximum number of sediment producing projects per HUC 10 (described in detail under section D. *Sideboards, Minimization Measures, and other Requirements*)

B. Oversight and Administration

In this section we outline the process for administration of the Program. To assist NOAA RC staff with the tracking and oversight of implemented Program projects, a Team comprised of NOAA RC (Arcata Office) staff and Corps (Eureka Office) staff was established. The Team will play an integral role in tracking both the overall number and locations of projects authorized under the Program each year, and ensure that the limits outlined below in section D "*Sideboards, Minimization Measures, and Other Requirements"* are adhered to. Additionally, the Team will maintain a database, tracking the overall incidental take of listed species that occurs during implementation of individual projects and the Program. The following summarizes the process for reviewing individual projects for consideration and authorization under the Program.

1. Submittal of Project Applications to be Considered for Authorization Under the Program

Project applications will come through the NOAA RC, or through the Corps at the time of application for a CWA section 404 permit, a Rivers and Harbors Act section 10 permit, or both. Applications for proposed projects will be submitted by the project applicant to the Team for consideration in the Program.

2. Timeline for Submittal and Review of Project Applications

Project applications will likely be submitted throughout the year to the Team, and distributed to the Team for review. As described below, Corps staff may request assistance from NOAA RC for input on whether projects are consistent with the Program. The Team will then bundle projects to be covered under the Program for review and processing (as described in the following steps) approximately twice a year, possibly in the early Winter (December/January) and Spring (March/April).

3. Submittal Requirements

Projects that either fall under a NOAA RC funding source or a Corps permit may be submitted to the Program using a standard application form provided by a Team member. The NOAA RC and the Corps will determine which projects are consistent with the Program requirements. Project proposals must supply sufficient information about their project to allow the Team to determine whether or not the project qualifies for coverage under the Program. Detailed submittal requirements are described in this biological opinion's subsection *Monitoring and Reporting Requirements*.

4. Initial Project Screening

The NOAA RC will be the first level of review in screening potential NOAA RC-funded projects for authorization under the Program. The NOAA RC will determine whether a proposed project comports to the conditions of the Program.

The Corps will be the first level of review in screening potential projects where the applicant applied for a Corps permit for authorization under the Program. The Corps will determine whether the proposed project comports to the conditions of the Program.

The Team will use a pre-established checklist (appendix B) to help determine if a proposed project fits within the parameters of the Program. Once projects have passed through the initial project screening by the Team, and any projects that do not fit are either further clarified or developed by the project proponent and resubmitted, the Team will compile a report (project summary sheet/table) for the bundled projects.

5. Corps and NOAA RC Authorization and Project Construction

With the Corps' and NOAA RC's written approval, authorized (*i.e.*, funded, permitted) projects are implemented by the applicants, incorporating applicable guidelines and required protection measures (described below).

6. Post-Construction Implementation Monitoring and Reporting

Applicants are required to conduct post-construction implementation monitoring and associated reporting requirements for their projects authorized under the Program. Monitoring and reporting will include photo-documentation (consistent with the pre-construction monitoring requirements), as-builts (post construction plans on engineered projects); evidence of implementation of required avoidance, minimization, and mitigation measures; and number (by species) of fish relocated and any fish mortality that resulted from the project. The applicant(s) shall submit this information to the Team within 6 months post-construction for data assembly—as described below.

7. Project Tracking and Annual Report

The Team will maintain a database of the monitoring information collected (*Monitoring and Submittal Requirements)* for all projects implemented under the Program. In order to monitor the effects to the protected ESUs, DPSs and critical habitats over the life of the Program, and to track incidental take of listed species, the Team will annually prepare and submit to the NMFS Northern California Office a report of the previous year's restoration activities. The annual report will contain information (as described in detail in section E. *Monitoring and Reporting Requirements*) about projects implemented during the previous construction season as well as projects implemented in prior years under the Program.

C. Description of Restoration Project Types

Habitat restoration projects authorized through the Program will be designed and implemented consistent with techniques and minimization measures presented in CDFG's *California Salmonid Stream Habitat Restoration Manual, Third Edition, Volume II* with four chapters *(Part IX: Fish Passage Evaluation at Stream Crossings, Part X: Upslope Assessment and Restoration Practices, Part XI: Riparian Habitat Restoration, and Part XII: Fish Passage Design and Implementation)* added in 2003, 2004, and 2009, respectively (Flosi et al. 1998, hereafter referred to as CDFG Manual). The Program requires avoidance and minimization practices for all projects to reduce the potential for ancillary effects to listed species and other riparian and aquatic species. These measures are described in subsection *D. Sideboards, Minimization Measures, and other Requirements.* Program activities are as follows:

1. Instream Habitat Structures and Improvements

Instream habitat structures and improvements are intended to provide predator escape and resting cover, increase spawning habitat, improve migration corridors, improve pool to riffle ratios, and add habitat complexity and diversity. Specific techniques for instream habitat improvement include: (1) placement of cover structures (divide logs, engineered log jams, digger logs, spider logs; and log, root wad, and boulder combinations), boulder structures (boulder weirs, vortex boulder weirs, boulder clusters, and single and opposing boulder-wing-deflectors), (2) log structures (log weirs, upsurge weirs, single and opposing log-wing-deflectors, engineered log jams, and Hewitt ramps), and (3) placement of imported spawning gravel. Implementation of these types of projects may require the use of heavy equipment (*e.g.*, self-propelled logging yarders, excavators, backhoes, helicopters), however, hand labor will be used when possible. Large woody debris (LWD) may also be placed in the stream channel to enhance pool formation and increase stream channel complexity. Projects will include both anchored and unanchored logs, depending on site conditions and wood availability.

2. Barrier Modification for Fish Passage Improvement

Barrier modification projects are intended to improve salmonid fish passage by (1) providing access to upstream habitat, (2) improving access to habitat, and (3) increasing the duration of accessibility (both within and between years). Projects may include those that improve fish passage through existing culverts, bridges, and paved and unpaved fords through replacement, removal, or retrofitting. In particular, these practices may include the use of gradient control weirs upstream or downstream of barriers to control water velocity, water surface elevation, or provide sufficient pool habitat to facilitate jumps, or interior baffles or weirs to mediate velocity and the increased water depth. Weirs may also be used to improve passage in flood control channels (particularly concrete lined channels). The Program also includes log jam modifications to facilitate juvenile and adult fish passage. Implementing these types of projects may require the use of heavy equipment (*e.g.*, self-propelled logging yarders, mechanical excavators, backhoes), however, hand labor will be used when possible.

Part IX of the CDFG Manual, entitled *Fish Passage Evaluation at Stream Crossings*, provides consistent methods for evaluating fish passage through culverts at stream crossings, and will aid in assessing fish passage through other types of stream crossings, such as bridges and paved or hardened fords. The objectives of Part IX are to provide the user with consistent methods for evaluating salmonid passage though stream crossings, ranking criteria for prioritizing stream crossing sites for treatment, treatment options to provide unimpeded fish passage, a stream crossing remediation project checklist, guidance measures to minimize impacts during stream crossing remediation construction, and methods for monitoring the effectiveness of corrective treatments.

The chapter in the CDFG Manual (Part XII), entitled *Fish Passage Design and Implementation*, provides technical guidance for the design of fish passage projects at stream crossings, small dams and water diversion structures. Part XII is intended to:

> guide designers through the general process of selecting a design approach for passage improvement. It provides concepts, a design framework, and procedures to design stream crossings and fishways that satisfy ecological objectives, including: efficient and safe passage of all aquatic organisms and life stages, continuity of geomorphic processes such as the movement of debris and sediment, accommodation of behavior and swimming ability of organisms to be passed, diversity of physical and hydraulic conditions leading to high diversity of passage opportunities, projects that are self-sustaining and durable, and passage of terrestrial organisms that move within the riparian corridor.

Where there is an opportunity to protect salmonids, additional site-specific criteria may be appropriate.

3. Bioengineering and Riparian Habitat Restoration

These projects are intended to improve salmonid habitat through increased stream shading intended to lower stream temperatures, increase future recruitment of LWD to streams, and increase bank stability and invertebrate production. Riparian habitat restoration projects will aid in the restoration of riparian habitat by increasing the number of plants and plant groupings, and will include the following types of projects: natural regeneration, livestock exclusionary fencing, bioengineering, and revegetation. Part XI of the CDFG Manual, *Riparian Habitat Restoration*, contains examples of these techniques.

Reduction of instream sediment will improve fish habitat and fish survival by increasing fish embryo and alevin survival in spawning gravels, reducing injury to juvenile salmonids from high concentrations of suspended sediment, and minimizing the loss of, or reduction in size of, pools from excess sediment deposition. The proposed activities will reduce stream sedimentation from bank erosion by stabilizing stream banks with appropriate site-specific techniques including: boulder-streambank stabilization structures, log-streambank stabilization structures, tree revetment, native plant material revetment, willow wall revetment, willow siltation baffles, brush mattresses, checkdams, brush checkdams, water bars, and exclusionary fencing. Guidelines for stream bank stabilization techniques are described in Part VII of the CDFG Manual, *Project Implementation*. These types of projects usually require the use of heavy equipment (*e.g.*, self-propelled logging yarders, mechanical excavators, backhoes).

4. Upslope Watershed Restoration

Upslope watershed restoration projects are intended to reduce delivery of sediment to anadromous salmonid streams. Part X of the CDFG Manual, *Upslope Assessment and Restoration Practices*, describes methods for identifying and assessing erosion, evaluating appropriate treatments, and implementing erosion control treatments. Road-related upslope watershed restoration projects include decommissioning, upgrading, and storm proofing. Implementation of these types of projects may require the use of heavy equipment (*e.g.*, self-propelled logging yarders, mechanical excavators, backhoes), however, hand labor will be used when possible.

5. Removal of Small Dams (permanent and flashboard)

a. *Project Description*

The CDFG Manual does not cover the removal of small dams, however guidelines and minimization measures have been developed in this proposed action. Types of small dams are permanent, flash board, and seasonal dams with the characteristics listed below. Implementing these types of projects may require the use of heavy equipment (*e.g.*, self-propelled logging yarders, mechanical excavators, backhoes). Dams removed in part or in whole, by the use of explosives are not included in the proposed action.

Dams included in the Program are defined by the California Division of Dam Safety (California Water Code, 2010):

> Any artificial barrier which either (a) is less than 25 feet in height from the natural bed of the stream or watercourse at the downstream toe of the barrier, or from the lowest elevation of the outside limit of the barrier to the maximum possible water storage elevation or (b) was designed to have an impounding capacity of less than 50 acre-feet.

In addition, this Program will only include dam removal that will form a channel at natural grade and shape upstream of the dam, naturally or with excavation, in order to minimize negative effects on downstream habitat. Dam removal projects will (1) have a relatively small volume of sediment available for release, that when released by storm flows, will have minimal effects on downstream habitat, or (2) are designed to remove sediment trapped by the dam down to the elevation of the target thalweg including design channel and floodplain dimensions. This can be accomplished by estimating the natural thalweg using an adequate longitudinal profile (CDFG Manual Part XII *Fish Passage Design and Implementation*) and designing a natural shaped channel that provides the same hydraulic conditions and habitat for listed fish that is provided by the natural channel and has the capacity to accommodate flows up to a 2-year flood.

b. *Minimization Measures*

- All construction will take place out of the wetted channel either by implementing the project from the bank and out of the channel or by constructing coffer dams, removing aquatic species located within the project reach, and dewatering the channel.

- No more than 250 linear feet (125 feet on each side of the channel) of riparian vegetation will be removed. All disturbed areas will be re-vegetated with native grasses, trees, or shrubs.

- All dewatering efforts associated with small dam removal will abide by the applicable minimization measures (Section D. *Sideboards, Minimization Measures, and Other Requirements*).

c. *Data Requirements and Analysis*

- A longitudinal profile of the stream channel thalweg for at least a distance equal to 20 channel widths upstream and downstream of the structure and long enough to establish the natural channel grade, whichever is farther, shall be used to determine the potential for channel degradation (as described in the CDFG Manual).

- A minimum of five cross-sections: one downstream of the structure, three roughly evenly spaced through the reservoir area upstream of the structure, and one upstream of the reservoir area outside of the influence of the structure to characterize the channel morphology and quantify the stored sediment.

- Sediment characterization within the reservoir and within a reference reach of a similar channel to determine the proportion of coarse sediment (>2mm) in the reservoir area and target sediment composition.

- A habitat typing survey (DFG Manual Part III, Habitat Inventory Methods) that maps and quantifies all downstream spawning areas that may be affected by sediment released by removal of the water control structure.

Projects will be deemed ineligible for the program if: (1) sediments stored behind dam have a reasonable potential to contain environmental contaminants [dioxins, chlorinated pesticides, polychlorinated biphenyls (PCB's), or mercury] beyond the freshwater probable effect levels (PELs) summarized in the NOAA Screening Quick Reference Table guidelines or (2) the risk of significant loss or degradation of downstream spawning or rearing areas by sediment deposition is considered to be such that the project requires more detailed analysis. Sites shall be considered to have a reasonable potential to contain contaminants of concern if they are downstream of historical contamination sources such as lumber or paper mills, industrial sites, or intensive agricultural production going back several decades (*i.e.*, since chlorinated pesticides were legal to purchase and use). In these cases, preliminary sediment sampling is advisable.

6. Creation of Off-channel/Side Channel Habitat

a. *Project Description*

The creation of off-channel or side channel habitat is not included in the CDFG Manual, however, guidelines and minimization measures have been developed in this proposed action. Types of side channel or off-channel restoration projects that will be eligible for the Program are:

- Connection of abandoned side channel or pond habitats to restore fish access
- Connection of adjacent ponds, remnants from aggregate excavation
- Connection of oxbow lakes on floodplains that have been isolated from the meandering channel by river management schemes, or channel incision
- Creation of side channel or off-channel habitat with self-sustaining channels
- Improvement of hydrologic connection between floodplains and main channels

Projects that involve the installation of a flashboard dam, head gate or other mechanical structure are not part of the Program. Off channel ponds constructed under this Program will not be used as a point of water diversion. Use of logs or boulders as stationary water level control structures will be allowed.

Restoration projects in this category may include: removal or breaching of levees and dikes, channel and pond excavation, creating temporary access roads, constructing wood or rock tailwater control structures, and construction of LWD habitat features. Implementation of these types of projects may require the use of heavy equipment (*e.g.*, self-propelled logging yarders, mechanical excavators, backhoes).

Information regarding consideration of water supply (channel flow/overland flow/groundwater), water quality, and reliability; risk of channel change; as well as, channel and hydraulic grade will be provided in the project proposal for review by the Team. A good reference document for designing off channel habitat features can be found in "Section 5.1.2 Side Channel/Off Channel Habitat Restoration in the Washington Department of Fish and Wildlife 2004 Stream Habitat Restoration Guidelines" (Saldi-Caromile et al. 2004).

b. *Minimization Measures*

To reduce the effects of turbidity the same measures described in the CDFG Manual for Instream Habitat Improvement projects will be required including:

- Any equipment work within a stream channel shall be performed in isolation from the flowing stream. If there is any flow when the work is done, coffer dams shall be constructed upstream and downstream of the excavation site and divert all flow from upstream of the upstream dam to downstream of the downstream dam. The coffer dams may be constructed from many different materials and methods to meet the objective, for example clean river gravel or sand bags, and may be sealed with sheet plastic. Foreign materials such as sand bags and any sheet plastic shall be removed from the stream upon project completion. In some cases, clean river gravel may be left in the stream, but the coffer dams must be breached to return the stream flow to its natural channel.

- If it is necessary to divert flow around the work site, either by pump or by gravity flow, the suction end of the intake pipe shall be fitted with a fish screen that meets CDFG and NMFS (NMFS 1997a) criteria to prevent entrainment or impingement of small fish. Any turbid water pumped from the work site shall be disposed of in an upland location where it will not drain directly into any stream channel, or treated via settling pond to filter suspended materials before flowing back into the stream.

If the Team determines that a proposed project requires extensive analysis, the project will undergo individual consultation.

7. <u>Developing Alternative Stockwater Supply</u>

a. *Project Description*

Many riparian fencing projects will require the development of off channel watering areas for livestock. These are often ponds that have been excavated and are filled either by rainwater, overland flow, surface diversions or groundwater (either through water table interception or pumping). The Program also covers water lines, watering troughs, and piping used to provide groundwater to livestock.

b. *Minimization Measures*

- Only projects with existing diversions compliant with water laws will be considered. In addition, storage reservoirs will not be greater than 10 acres in size. Flow measuring device installation and maintenance may be required for purposes of accurately measuring and managing pumping rate or bypass conditions set forth in this document or in the water right or special use permit.

- All pump intakes will be screened in accordance with NMFS Southwest Region "Fish Screening Criteria for Salmonids" (NMFS 1997a).
- Stockwater ponds and wells will be located at least 100 feet from the edge of the active channel and are not likely to cause stranding of juvenile salmonids during flood events.

8. Tailwater Collection Ponds

a. *Project Description*

Tailwater is created in flood irrigation operations as unabsorbed irrigation water flows back into the stream. Restoration projects to address tailwater input will construct tailwater capture systems to intercept tailwater before it enters streams. Water held in capture systems, such as a pond, can be reused for future irrigation purposes, therefore reducing the need for additional stream diversions.

b. *Minimization Measures*

- Tailwater collection ponds that do not incorporate return channels to the creek will be located at least 100 feet from the edge of the active channel and are not likely to cause stranding of juvenile salmonids during flood events.

9. Water Storage Tanks

a. Project Description

Water storage tanks could either be filled through rainwater catchment or by surface or groundwater flow. Under this programmatic, all water storage tank projects will be required to enter into a forbearance agreement for at least 10 years, which will provide temporal and quantitative assurances for pumping activities that result in less water withdrawal during summer low flow period. The low flow threshold, measured in cubic feet per second (cfs) season of diversion and season of storage, will be determined in collaboration with CDFG and NOAA RC on a site by site basis. Water storage capacity for the water diversion forbearance period must be of sufficient capacity to provide for all water needs during that time period. For example, if the no-pump period is 105 days (August to November), the diverters must have enough storage to cover any domestic, irrigation, or livestock needs during that time.

b. *Minimization Measures*

- All pump intakes will be properly screened in accordance with NMFS (1996, 1997a) fish screen criteria.

Water conservation projects that include water storage tanks and a Forbearance Agreement for the purpose of storing winter and early spring water for summer and fall use, require registration of water use pursuant to California Water Code § 1228.3, and require consultation with CDFG. Diversions to fill storage facilities during the winter and spring months shall be made pursuant to a Small Domestic Use Appropriation (SDU) filed with the State Water Resources Control Board (SWRCB).

10. Piping Ditches

a. *Project Description*

Piping projects consist of constructing a pipe to transport irrigation water instead of a ditch, thereby reducing evaporation and absorption. Water saved by these projects will remain in the stream for anadromous salmonid benefits. Applicants must demonstrate that they intend to dedicate water for instream beneficial use by filing a *Petition for Instream Flow Dedication* (California Water Code § 1707, 1991) and make progress towards instream dedication**.**

b. *Minimization Measures*

- Only water conservation piping projects that result in a decrease in the diversion rate with a permitted instream dedication of the water saved are included in the Program.
- Landowners will enter an agreement with NOAA RC or the Corps stating that they will maintain the pipe for at least 10 years.

11. Fish Screens

a. *Project Description*

This category includes the installation, operation, and maintenance of the types of fish screens described below, provided they meet the NMFS (1996, 1997a) fish screening criteria. Installing a fish screen usually includes site excavation, forming and pouring a concrete foundation and walls, excavation and installation of a fish bypass pipe or channel, and installation of the fish screen structure. Heavy equipment is typically used for excavation of the screen site and bypass. If the fish screen is placed within or near flood prone areas, typically rock or other armoring is installed to protect the screen. The average area of the bed, channel, and bank disturbed by the installation of a bypass pipe or channel ranges from 40 to 100 square feet, based on past Scott and Shasta river screening projects. Fish screen types include:

- Self-cleaning screens, including flat plate self-cleaning screens, and other self-cleaning designs, including, but not limited to, rotary drum screens and cone screens, with a variety of cleaning mechanisms, consistent with NMFS fish screening criteria (1996, 1997a).

- Non-self-cleaning screens, including tubular, box, and other screen designs consistent with NMFS screening criteria (1996, 1997a).

b. *Minimization Measures*

- All flows will be diverted around work areas as described in the *Requirements for Fish Relocation and Dewatering Activities.*
- Fish removal may be required at project sites and BMPs will be implemented as described in the *Requirements for Fish Relocation and Dewatering Activities.*
- Riparian disturbance will be minimized as described in the *Measures to Minimize Loss or Disturbance of Riparian Vegetation.*

12. <u>Headgates and Water Measuring Devices</u>

a. *Project Description*

Measuring devices are typically installed with the head gate to allow water users to determine the volume of water diverted. Headgate installation projects must clearly demonstrate habitat restoration benefits.

b. *Minimization Measures*

- The application must include, instream and ditch/pump hydraulic calculations showing there is sufficient head to divert maximum diversion flow and bypass flow at minimum stream flow considering head losses at flow measurement devices, fish screens, pipes, open ditches, and headgates.
- Measuring devices must be approved by DWR for watersheds with DWR water master service. Otherwise, measuring devices must conform to the *2001 Bureau of Reclamation Water Measurement Manual* (BOR 2001).
- Design drawings must show structural dimensions in plan, elevation, longitudinal profile, and cross-sectional views along with important component details.
- All flows will be diverted around work areas as described in Section II B. *Requirements for Fish Relocation and Dewatering Activities.*
- Fish removal may be required at project sites and BMPs are described in Section II B. *Requirements for Fish Relocation and Dewatering Activities.*
- Riparian disturbance will be minimized as described in Section II E. *Measures to Minimize Loss or Disturbance of Riparian Vegetation.*

D. Sideboards, Minimization Measures, and other Requirements

A key component of the Program involves the use of sideboards that establish a minimum distance between instream projects and limit the number of instream projects annually within a watershed; relative to the size of the watershed. These sideboards also establish specific, measureable project metrics that assist with the analysis of effects. Additionally, the NOAA RC and Corps have established additional requirements and minimization measures that must be implemented for projects included in the Program. The following are the sideboards, minimization measures, and other requirements proposed by the NOAA RC and Corps for proposed projects:

1. <u>Sideboards for all Water Conservation Projects</u>

a. *Compliance with Water Rights*

All water conservation projects in the Program will require diverters to verify compliance with water rights — as conditioned by a small domestic use or livestock stockpond registration, appropriative water right, or a statement of riparian water use registered with the State Water Resources Control Board and reviewed for compliance with California Fish and Game Code (which may require a Lake or Streambed Alteration Agreement and possibly, a California Environmental Quality Act (CEQA) analysis) by the NOAA RC and the Corps.

b. Site-Specific Restrictions

Restrictions on water diversions from a stream or from hydrologically connected sources (such as springs or groundwater that would contribute to streamflow) are often site-specific. Many of the water conservation projects require change to diversion timing or rates, however, site-specific restrictions to those permits may make a project ineligible to the Program or subject to additional requirements. Diversion permits may have limits on or requirements for:

- Season of diversion
- Rates of diversion
- Possible time-of-day restrictions (avoiding daytime peak in forest evapotranspiration and water temperature, or coordination with other users)
- Fish screen requirements for direct diversions
- Requirements for water storage during high flow periods for use in low flow periods
- Flow or diversion monitoring and reporting.

c. Protection of Instream Flows

The following restrictions are intended to protect instream flows beneficial to fish rearing, spawning, and movement as well as providing habitat native amphibians and other aquatic species. Water conservation projects that involve diversions will need additional information to help the NOAA RC and Corps determine the benefits to fish and if the proposed design is appropriate for the individual project site. The following information will be required:

- Proposed rate of diversion
- Season of diversion
- Diversion records (riparian and appropriative) both upstream and downstream of the project site
- Estimated water use and storage needs for proposed project
- Household/property water conservation plan (low flow shower heads, toilets, etc.)
- Estimated stream gradient and substrate
- Method of accurately measuring diversion rate

2. Engineering Requirements

More complex project types covered by the Program require a higher level of oversight (engineering review, etc.) and review by an engineer. These project types will include:

- Fish passage at stream crossings
- Permanent removal of flashboard dam abutments and sills.
- Small dam removal
- Creation and connection of off channel habitat features

Specific requirements associated with these more complex project types include the following:

- For road-stream crossings and small dam projects, if the stream at the project location was not passable to or was not utilized by all life stages of all listed salmonids in the project area prior to the existence of the road crossing, the project shall pass the life stages and covered salmonid species that historically existed. Retrofitted culverts shall meet the fish passage criteria for the passage needs of the listed species and life stages historically passing through the site prior to the existence of the road crossing, according to CDFG stream crossing criteria (*CDFG Culvert Criteria for Fish Passage* (Appendix IX-A, CDFG Manual).
- All designs for dam removal, off channel habitat features, and fish passage projects will be reviewed by engineers, ensuring the requirements have been met prior to commencement of work. Off channel habitat projects that reduce the potential for stranding using water control structures will be encouraged, but uncertainties in future stream flows and drought conditions cannot be predicted and may result in fish stranding in certain flow conditions.

3. Prohibited Activities

Projects that include any of the following elements would not be authorized under the Program:

- Use of gabion baskets.
- Use of cylindrical riprap (aqualogs).
- Chemically-treated timbers used for any instream structures.
- Activity that substantially disrupts the movement of those species of aquatic life indigenous to the waterbody, including those species that normally migrate through the action area.
- Projects that would completely eliminate a riffle/pool complex (*note: there may be some instances where a riffle/pool complex is affected/modified by a restoration project [i.e. a culvert removal that affects an existing pool]. These types of projects would be allowed under the Program).*

4. Limits on Area of Disturbance for Individual Projects

a. *Stream Dewatering*

Maximum length of stream that can be dewatered is 1000 feet.

b. *Upslope Disturbance (raw dirt, tree removal, canopy cover reduction)*

- The disturbance footprint for any individual project staging area may not exceed 0.25 acres.
- Native trees with defects, snags >16 in. diameter at breast height (dbh) and 20 ft high, cavities, leaning toward the stream channel, nests, late seral characteristics, or > 36 in. dbh will be retained. In limited cases removal will be permitted if trees/snags are growing in culvert fill and need to be removed during the crossing upgrade or removal.
- Downed trees (logs) >24 in. dbh and 10-ft-long will be retained on upslope sites.
- The general construction season will be from June 15 to November 1. Restoration, construction, fish relocation, and dewatering activities within any wetted and/or flowing creek channel shall only occur within this period.

c. *Buffer Between Projects Implemented in the Same Year*

All projects implemented in the same year will maintain an 800 ft downstream buffer from any other sediment producing projects proposed for implementation that same year under the Program.

6. Limit on Total Number of Projects Annually

Up to 60 projects may be authorized (via NOAA RC funding, Corps permit, or both) each year under the Program. There will also be an annual per-watershed limitation of projects occurring in any one HUC 10 watershed per year to be authorized under this Program. The number of sediment-producing projects (*i.e.*, instream habitat improvement, instream barrier removal, stream bank stabilization, fish passage improvement, removal of small dams, creation of off-channel/side channel habitat, upslope road work, and fish screen construction) will be limited per HUC 10 by the watershed size (table 1). When defining the sideboard that restricts the number of projects per HUC 10, road decommissioning projects are considered to be one project regardless of the intensity of the project. A list of all HUC 10 watersheds and the number of sediment producing projects allowed based on the restrictions described in table 1 can be found in appendix A.

Table 1. Maximum Number of Sediment-Producing Projects per HUC 10 Watersheds

HUC 10 mi.²	**Max. # of Sediment-Producing Projects**	**Scenarios for Sediment-Producing Projects**
<50	2	1 project per 9.1 mi.²
50-100	3	1 project per 17.3 mi.²
100-150	4	1 project per 25.0 mi.²
150-250	5	1 project per 30.3 mi.²
250-350	6	1 project per 40.9 mi.²
>350	7	1 project per 53.2 mi.²

7. Limit on Distance between Projects

Stream crossing activities within a single project will be limited in accordance to the sideboard which limits distance. Any stream crossing removals in fish bearing streams must be 800 ft (stream distance) apart and crossings in a non-fish-bearing stream must be 500 ft (stream distance) apart.

8. Limits on Removal of Vegetation

Removal of exotic, invasive riparian vegetation in a stream with high water temperatures must be done in a manner to avoid creation of additional temperature loading to fish-bearing streams. If a stream has a 7-day moving average daily maximum (7DMADM) temperature greater than 17.8 ºC in a coho salmon or steelhead stream, or greater than 18.5 ºC in a steelhead only stream, and vegetation management would reduce overstory shade canopy to the wetted channel, then the practice will not be allowed.

9. Protection Measures

The following protection measures, as they apply to a particular project, shall be incorporated into the project descriptions for individual projects authorized under the Program.

a. *General Protection Measures*

- Work shall not begin until (a) the Corps and/or NOAA RC has notified the applicant to the Program that the requirements of the ESA have been satisfied and that the activity is authorized and (b) all other necessary permits and authorizations are finalized.
- The general construction season shall be from June 15 to November 1. Restoration, construction, fish relocation, and dewatering activities within any wetted or flowing stream channel shall only occur within this period. Revegetation outside of the active channel may continue beyond November 1, if necessary.
- Prior to construction, any contractor shall be provided with the specific protective measures to be followed during implementation of the project. In addition, a qualified biologist shall provide the construction crew with information on the listed species and State Fully Protected Species in the project area, the protection afforded the species by the ESA, and guidance on those specific protection measures that must be implemented as part of the project.
- All activities that are likely to result in negative aquatic effects, including temporary effects, shall proceed through a sequencing of effect reduction: avoidance, reduction in magnitude of effect, and compensation (mitigation). Mitigation may be proposed to compensate for negative effects to waters of the United States. Mitigation shall generally be in kind, with no net loss of waters of the United States on a per project basis. Mitigation work shall proceed in advance or concurrently with project construction.
- Poured concrete shall be excluded from the wetted channel for a period of 30 days after it is poured. During that time the poured concrete shall be kept moist, and runoff from the concrete shall not be allowed to enter a live stream. Commercial sealants may be applied to the poured concrete surface where difficulty in excluding water flow for a long period may occur. If sealant is used, water shall be excluded from the site until the sealant is dry and fully cured according to the manufacturers specifications.
- If the thalweg of the stream has been altered due to construction activities, efforts shall be undertaken to reestablish it to its original configuration[1].

b. *Requirements for Fish Relocation and Dewatering Activities*

(1) Guidelines for dewatering. Project activities funded or permitted under the Program may require fish relocation or dewatering activities. Dewatering may not be appropriate for some projects that will result in only minor input of sediment, such as placing logs with hand crews, or installing boulder clusters. Dewatering can result in the temporary loss of aquatic habitat, and the stranding, or displacement of fish and amphibian species. Increased turbidity may occur from

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1 Projects that may include activities, such the use of willow baffles, which may alter the thalweg are allowed

disturbance of the channel bed. The following guidelines may minimize potential effects for projects that require dewatering of a stream:

- In those specific cases where it is deemed necessary to work in flowing water, the work area shall be isolated and all flowing water shall be temporarily diverted around the work site to maintain downstream flows during construction.
- Exclude fish from occupying the work area by blocking the stream channel above and below the work area with fine-meshed net or screens. Mesh will be no greater than 1/8 inch diameter. The bottom of a seine must be completely secured to the channel bed. Screens must be checked twice daily and cleaned of debris to permit free flow of water. Block nets shall be placed and maintained throughout the dewatering period at the upper and lower extent of the areas where fish will be removed. Block net mesh shall be sized to ensure salmonids upstream or downstream do not enter the areas proposed for dewatering between passes with the electrofisher or seine.
- Prior to dewatering, determine the best means to bypass flow through the work area to minimize disturbance to the channel and avoid direct mortality of fish and other aquatic vertebrates (as described more fully below under ***General conditions for all fish capture and relocation activities***.
- Coordinate project site dewatering with a qualified biologist to perform fish and amphibian relocation activities. The qualified biologist(s) must possess a valid state of California Scientific Collection Permit as issued by the CDFG and must be familiar with the life history and identification of listed salmonids and listed amphibians within the action area.
- Prior to dewatering a construction site, qualified individuals will capture and relocate fish and amphibians to avoid direct mortality and minimize adverse effects. This is especially important if listed species are present within the project site.
- Minimize the length of the dewatered stream channel and duration of dewatering, to the extent practicable.
- Any temporary dam or other artificial obstruction constructed shall only be built from materials such as sandbags or clean gravel which will cause little or no siltation. Visqueen shall be placed over sandbags used for construction of cofferdams construction to minimize water seepage into the construction areas. Visqueen shall be firmly anchored to the streambed to minimize water seepage. Coffer dams and stream diversion systems shall remain in place and fully functional throughout the construction period.
- When coffer dams with bypass pipes are installed, debris racks will be placed at the bypass pipe inlet. Bypass pipes will be monitored a minimum of two times per day, seven days a week. All accumulated debris shall be removed.
- Bypass pipes will be sized to accommodate, at a minimum, twice the summer baseflow.
- The work area may need to be periodically pumped dry of seepage. Place pumps in flat areas, well away from the stream channel. Secure pumps by tying off to a tree or stake in place to prevent movement by vibration. Refuel in an area well away from the stream channel and place fuel absorbent mats under pump while refueling. Pump intakes shall

be covered with 1/8 inch mesh to prevent potential entrainment of fish or amphibians that failed to be removed. Check intake periodically for impingement of fish or amphibians.

- If pumping is necessary to dewater the work site, procedures for pumped water shall include requiring a temporary siltation basin for treatment of all water prior to entering any waterway and not allowing oil or other greasy substances originating from operations to enter or be placed where they could enter a wetted channel. Projects will adhere to NMFS Southwest Region *Fish Screening Criteria for Salmonids* (NMFS 1997a).
- Discharge sediment-laden water from construction area to an upland location or settling pond where it will not drain sediment-laden water back to the stream channel.
- When construction is complete, the flow diversion structure shall be removed as soon as possible in a manner that will allow flow to resume with the least disturbance to the substrate. Cofferdams will be removed so surface elevations of water impounded above the cofferdam will not be reduced at a rate greater than one inch per hour. This will minimize the probability of fish stranding as the area upstream becomes dewatered.

(2) General conditions for all fish capture and relocation activities:

- Fish relocation and dewatering activities shall only occur between June 15 and November 1 of each year.
- All seining, electrofishing, and relocation activities shall be performed by a qualified fisheries biologist. The qualified fisheries biologist shall capture and relocate listed salmonids prior to construction of the water diversion structures (*e.g.*, cofferdams). The qualified fisheries biologist shall note the number of salmonids observed in the affected area, the number and species of salmonids relocated, where they were relocated to, and the date and time of collection and relocation. The qualified fisheries biologist shall have a minimum of three years field experience in the identification and capture of salmonids, including juvenile salmonids, considered in this biological opinion. The qualified biologist will adhere to the following requirements for capture and transport of salmonids:
    - Determine the most efficient means for capturing fish (*i.e.*, seining, dip netting, trapping, electrofishing). Complex stream habitat generally requires the use of electrofishing equipment, whereas in outlet pools, fish may be concentrated by pumping-down the pool and then seining or dipnetting fish.
    - Notify NMFS one week prior to capture and relocation of salmonids to provide NMFS an opportunity to monitor.
    - Initial fish relocation efforts will be conducted several days prior to the start of construction. This provides the fisheries biologist an opportunity to return to the work area and perform additional electrofishing passes immediately prior to construction. In many instances, additional fish will be captured that eluded the previous day's efforts.
    - In streams with high water temperature, perform relocation activities during morning periods.

- Prior to capturing fish, determine the most appropriate release location(s). Consider the following when selecting release site(s):
    - Similar water temperature as capture location
    - Ample habitat for captured fish
    - Low likelihood of fish reentering work site or becoming impinged on exclusion net or screen.
    - Fish must be released in a nearby location within the same HUC 8 watershed
- Periodically measure air and water temperatures. Cease activities when measured water temperatures exceed 17.8 ºC. Temperatures will be measured at the head of riffle tail of pool interface.

(3) Electrofishing Guidelines. The following methods shall be used if fish are relocated via electrofishing:

- All electrofishing will be conducted according to NMFS *Guidelines for Electrofishing Waters Containing Salmonids Listed Under the Endangered Species Act* (2000).
- The backpack electrofisher shall be set as follows when capturing fish:

Voltage setting on the electrofisher shall not exceed 300 volts.

	Initial	Maximum
A) Voltage:	100 Volts	300 Volts
B) Duration:	500 µs (microseconds)	5 ms (milliseconds)
C) Frequency:	30 Hertz	70 Hertz

- A minimum of three passes with the electrofisher shall be conducted to ensure maximum capture probability of salmonids within the area proposed for dewatering.
- No electrofishing shall occur if water conductivity is greater than 350 microSiemens per centimeter (µS/cm) or when instream water temperatures exceed 17.8 °C. Water temperatures shall be measured at the pool/riffle interface. Direct current (DC) shall be used.
- A minimum of one assistant shall aid the fisheries biologist by netting stunned fish and other aquatic vertebrates.

(4) Seining guidelines. The following methods, shall be used if fish are removed with seines.

- A minimum of three passes with the seine shall be utilized to ensure maximum capture probability of salmonids within the area.
- All captured fish shall be processed and released prior to each subsequent pass with the seine.

- The seine mesh shall be adequately sized to ensure fish are not gilled during capture and relocation activities.

(5) Guidelines for relocation of salmonids. The following methods shall be used during relocation activities associated with either method of capture (electrofishing or seining):

- Salmonid fish shall not be overcrowded into buckets; allowing approximately six cubic inches per young-of-the-year (0+) individual and more for larger fish.
- Every effort shall be made not to mix 0+ salmonids with larger salmonids, or other potential predators. Have at least two containers and segregate 0+ fish from larger age-classes. Place larger amphibians, such as Pacific giant salamanders, in container with larger fish.
- Salmonid predators, such as sculpins (*Cottus sp*.) and Pacific-giant salamanders (*Dicamptodon ensatus)* collected and relocated during electrofishing or seining activities shall be relocated so as to not concentrate them in one area. Particular emphasis shall be placed on avoiding relocation of sculpins and Pacific-giant salamanders into the steelhead and coho salmon relocation pools. To minimize predation on salmonids, these species shall be distributed throughout the wetted portion of the stream so as not to concentrate them in one area.
- All captured salmonids shall be relocated, preferably upstream, of the proposed construction project and placed in suitable habitat. Captured fish shall be placed into a pool, preferably with a depth of greater than two feet with available instream cover.
- All captured salmonids will be processed and released prior to conducting a subsequent electrofishing or seining pass.
- All native captured fish will be allowed to recover from electrofishing before being returned to the stream.
- Minimize handling of salmonids. When handling is necessary, always wet hands or nets prior to touching fish. Handlers will not wear DEET based insect repellants.
- Temporarily hold fish in cool, shaded, aerated water in a container with a lid. Provide aeration with a battery-powered external bubbler. Protect fish from jostling and noise and do not remove fish from this container until time of release.
- Place a thermometer in holding containers and, if necessary, periodically conduct partial water changes to maintain a stable water temperature. If water temperature reaches or exceeds 18 °C. , fish shall be released and rescue operations ceased.
- In areas where aquatic vertebrates are abundant, periodically cease capture, and release at predetermined locations.
- Visually identify species and estimate year-classes of fishes at time of release. Record the number of fish captured. Avoid anesthetizing or measuring fish.
- If more than three percent of the steelhead, Chinook salmon, or coho salmon captured are killed or injured, the project lead shall contact NMFS PRD and CDFG. The purpose of the contact is to allow the agencies a courtesy review of activities resulting in take and to determine if additional protective measures are required. All steelhead, Chinook salmon,

and coho salmon mortalities must be retained, placed in an appropriately sized whirl-pak or zip-lock bag, labeled with the date and time of collection, fork length, location of capture, and frozen as soon as possible. Frozen samples must be retained until specific instructions are provided by NMFS.

c. *Measures to Minimize Disturbance from Instream Construction*

Measures to minimize disturbance associated with instream habitat restoration construction activities are presented below.

- If the stream channel is seasonally dry between June 15 and November 1, construction will only occur during this dry period.
- Debris, soil, silt, excessive bark, rubbish, creosote-treated wood, raw cement/concrete or washings thereof, asphalt, paint or other coating material, oil or other petroleum products, or any other substances which could be hazardous to aquatic life, resulting from project related activities, shall be prevented from contaminating the soil or entering the waters of the United States. Any of these materials, placed within or where they may enter a stream or lake, by the applicant or any party working under contract, or with permission of the applicant, shall be removed immediately. During project activities, all trash that may attract potential predators of salmonids will be properly contained, removed from the work site, and disposed of daily.
- Where feasible, the construction shall occur from the bank, or on a temporary pad underlain with filter fabric.
- Use of heavy equipment shall be avoided in a channel bottom with rocky or cobbled substrate. If access to the work site requires crossing a rocky or cobbled substrate, a rubber tire loader/backhoe is the preferred vehicle. Only after this option has been determined infeasible will the use of tracked vehicles be considered. The amount of time this equipment is stationed, working, or traveling within the creek bed shall be minimized. When heavy equipment is used, woody debris and vegetation on banks and in the channel shall not be disturbed if outside of the project's scope.
- All mechanized equipment working in the stream channel or within 25 feet of a wetted channel shall have a double containment system for diesel and oil fluids. Hydraulic fluids in mechanical equipment working within the stream channel shall not contain organophosphate esters. Vegetable based hydraulic fluids are preferred.
- The use or storage of petroleum-powered equipment shall be accomplished in a manner to prevent the potential release of petroleum materials into waters of the state (Fish and Game Code 5650).
- Areas for fuel storage, refueling, and servicing of construction equipment must be located in an upland location.
- Prior to use, clean all equipment to remove external oil, grease, dirt, or mud. Wash sites must be located in upland locations so wash water does not flow into a stream channel or adjacent wetlands.

- All construction equipment must be in good working condition, showing no signs of fuel or oil leaks. Prior to construction, all mechanical equipment shall be thoroughly inspected and evaluated for the potential of fluid leakage. All mechanical equipment shall be inspected on a daily basis to ensure there are no motor oil, transmission fluid, hydraulic fluid, or coolant leaks. All leaks shall be repaired in the equipment staging area or other suitable location prior to resumption of construction activity.
- Oil absorbent and spill containment materials shall be located on site when mechanical equipment is in operation with 100 feet of the proposed watercourse crossings. If a spill occurs, no additional work shall commence in-channel until (1) the mechanical equipment is inspected by the contractor, and the leak has been repaired, (2) the spill has been contained, and (3) CDFG and NOAA RC are contacted and have evaluated the impacts of the spill.

d. Measures to Minimize Degradation of Water Quality

Construction or maintenance activities for projects covered under the Program may result in temporary increases in turbidity levels in the stream. The following measures will be implemented to reduce the potential for adverse effects to water quality during and post-construction:

(1) General erosion control during construction:

- When appropriate, isolate the construction area from flowing water until project materials are installed and erosion protection is in place.
- Effective erosion control measures shall be in place at all times during construction. Do not start construction until all temporary control devices (*e.g.*, straw bales with sterile, weed free straw, silt fences*)* are in place downslope or downstream of project site within the riparian area. The devices shall be properly installed at all locations where the likelihood of sediment input exists. These devices shall be in place during and after construction activities for the purposes of minimizing fine sediment and sediment/water slurry input to flowing water and detaining sediment-laden water on site. If continued erosion is likely to occur after construction is complete, then appropriate erosion prevention measures shall be implemented and maintained until erosion has subsided. Erosion control devices such as coir rolls or erosion control blankets will not contain plastic netting of a mesh size that would entrain reptiles (esp. snakes) and amphibians.
- Sediment shall be removed from sediment controls once it has reached one-third of the exposed height of the control. Whenever straw bales are used, they shall be sterile and weed free, staked and dug into the ground 12 cm. Catch basins shall be maintained so that no more than 15 cm of sediment depth accumulates within traps or sumps.
- Sediment-laden water created by construction activity shall be filtered before it leaves the settling pond or enters the stream network or an aquatic resource area.

- The contractor/applicant to the Program is required to inspect, maintain or repair all erosion control devices prior to and after any storm event, at 24 hour intervals during extended storm events, and a minimum of every two weeks until all erosion control measures have been completed.

(2) Guidelines for temporary stockpiling:

- Minimize temporary stockpiling of material. Stockpile excavated material in areas where it cannot enter the stream channel. Prior to start of construction, determine if such sites are available at or near the project location. If nearby sites are unavailable, determine location where material will be deposited. Establish locations to deposit spoils well away from watercourses with the potential to delivery sediment into streams supporting, or historically supporting populations of listed salmonids. Spoils shall be contoured to disperse runoff and stabilized with mulch and (native) vegetation. Use devices such as plastic sheeting held down with rocks or sandbags over stockpiles, silt fences, or berms of hay bales, to minimize movement of exposed or stockpiled soils.
- If feasible, conserve topsoil for reuse at project location or use in other areas. End haul spoils away from watercourses as soon as possible to minimize potential sediment delivery.

(3) Minimizing potential for scour:

- When needed, utilize instream grade control structures to control channel scour, sediment routing, and headwall cutting.
- For relief culverts or structures, if a pipe or structure that empties into a stream is installed, an energy dissipater shall be installed to reduce bed and bank scour. This does not apply to culverts in fish bearing streams.
- The toe of rock slope protection used for streambank stabilization shall be placed below the bed scour depth to ensure stability.

(4) Post construction erosion control:

- Immediately after project completion and before close of seasonal work window, stabilize all exposed soil with erosion control measures such as mulch, seeding, and/or placement of erosion control blankets. Remove all artificial erosion control devices after the project area has fully stabilized. All exposed soil present in and around the project site shall be stabilized after construction. Erosion control devices such as coir rolls or erosion control blankets will not contain plastic netting of a mesh size that would entrain reptiles (esp. snakes) and amphibians.
- All bare and/or disturbed slopes (> 100 square ft of bare mineral soil) will be treated with erosion control measures such as hay bales, netting, fiber rolls, and hydroseed as permanent erosion control measures.

- Where straw, mulch, or slash is used as erosion control on bare mineral soil, the minimum coverage shall be 95 percent with a minimum depth of two inches.
- When seeding is used as an erosion control measure, only seeds from native plant species will be used. Sterile (without seeds), weed-free straw, free of exotic weeds, is required when hay or hay bales are used as erosional control measures.

e. Measures to Minimize Loss or Disturbance of Riparian Vegetation

Measures to minimize loss or disturbance to riparian vegetation are described below. The revegetation and success criteria that will be adhered to for projects implemented under this Program that result in disturbance to riparian vegetation are also described below.

(1) Minimizing disturbance:

- Retain as many trees and brush as feasible, emphasizing shade-producing and bank-stabilizing trees and brush.
- Prior to construction, determine locations and equipment access points that minimize riparian disturbance. Avoid entering unstable areas. Use project designs and access points that minimize riparian disturbance without affecting less stable areas, which may increase the risk of channel instability.
- Minimize soil compaction by using equipment with a greater reach or that exerts less pressure per square inch on the ground than other equipment, resulting in less overall area disturbed or less compaction of disturbed areas.
- If riparian vegetation is to be removed with chainsaws, consider using saws that operate with vegetable-based bar oil.

(2) Revegetation and success criteria:

- Any stream bank area left barren of vegetation as a result of the implementation or maintenance of the practices shall be restored to a natural state by seeding, planting, or other means with native trees, shrubs, or grasses prior to November 15 of the project year. Barren areas shall typically be planted with a combination of willow stakes, native shrubs and trees and/or erosion control grass mixes.
- Native plant species shall be used for revegetation of disturbed and compacted areas. The species used shall be specific to the project vicinity or the region of the state where the project is located, and comprise a diverse community structure (plantings shall include both woody and herbaceous species).
- For projects where re-vegetation is implemented to compensate for riparian vegetation impacted by project construction, a re-vegetation monitoring report will be required after 5 years to document success. Success is defined as 70 percent survival of plantings or 70 percent ground cover for broadcast planting of seed after a period of 3 years. If revegation efforts will be passive (*i.e.*, natural regeneration), success will be defined as

total cover of woody and herbaceous material equal to or greater than pre-project conditions. If at the end of five years, the vegetation has not successfully been re-established, the project applicant to the Program will be responsible for replacement planting, additional watering, weeding, invasive exotic eradication, or any other practice, to achieve the revegetation requirements. If success is not achieved within the first 5 years, the project applicant will need to prepare a follow-up report in an additional 5 years. This requirement will proceed in 5 year increments until success is achieved.

- All plastic exclusion netting placed around plantings will be removed after 3 years.

f. Measures to Minimize Impacts to Roads in Project Area

When defining the sideboard which restricts the number of projects per HUC 10 (Table 1), road decommissioning projects are considered to be one project; however, intensity of the project is buffered by the sideboards related to road-stream crossing removals, a sediment-producing activity.

Stream crossing activities within the project will be limited in accordance to the sideboard which limits distance to minimize cumulating sediment effects. Any stream crossing removals in a fish bearing stream must be 800 ft apart and crossings in a non-fish-bearing stream must be 500 ft apart.

Upon the completion of restoration activities, roads within the riparian zone damaged by the permitted activity shall be weather proofed according to measures as described in *Handbook for Forest and Ranch Roads* by Weaver and Hagans (1994) of Pacific Watershed Associates and in Part X of the CDFG Manual entitled "*Upslope Assessment and Restoration Practices.*" The following are some of the methods that may be applied to roads impacted by project activities implemented under this Program.

- Establish waterbreaks (*e.g.*, waterbars and rolling dips) on all seasonal roads, skid trails, paths, and fire breaks by October 15. Do not remove waterbreaks until May 15.
- Maximum distance between waterbreaks shall not exceed the following standards: (1) 100 feet for road or trail gradients less than 10 percent slope; (2) 75 feet for road or trail gradients from 11 to 25 percent; (3) 50 feet for road or trail gradients from 26 to 50 percent slope; and (4) 50 feet for road or trail gradients greater than 50 percent slope. Depending on site-specific conditions more frequent intervals may be required to prevent road surface rilling and erosion.
- Locate waterbreaks to allow water to be discharged onto some form of vegetative cover, slash, rocks, or less erodible material. Do not discharge waterbreaks onto unconsolidated fill.
- Waterbreaks shall be cut diagonally a minimum of six inches into the firm roadbed, skid trail, or firebreak surface and shall have a continuous firm embankment of at least six inches in height immediately adjacent to the lower edge of the waterbreak cut.

- The maintenance period for waterbreaks and any other erosion control facilities shall occur after every major storm event for the first year after installation.
- Rolling-dips are preferred over waterbars. Waterbars shall only be used on unsurfaced roads where winter use (including use by bikes, horses, and hikers) will not occur.
- After the first year of installation, erosion control facilities shall be inspected for failure prior to the winter period (October 15) after the first major storm event, and prior to the end of the winter period (May 15). If the erosion controls have failed, additional erosion control elements will be installed to the project site.
- Applicant will establish locations to deposit spoils well away from watercourses with the potential to delivery sediment into streams supporting, or historically supporting populations of listed salmonids. Spoils shall be contoured to disperse runoff and stabilized with mulch and (native) vegetation.
- No berms are allowed on the outside of the road edge.
- No herbicides shall be used on vegetation on inside ditches.

E. Monitoring and Reporting Requirements

1. Pre-Project Monitoring and Submittal Requirements

The following information will be collected by the Program applicants with assistance from qualified biologists. Program applicants will submit the following information either to the Corps (as part of their application for a Corps Permit) or directly to NOAA RC (for NOAA RC funded projects) for project tracking and data reporting requirements. Program applicants will be responsible for obtaining any other necessary permits or authorizations from appropriate agencies before the start of project including, but not limited to a State Water Quality 401 Certification and local County permits. Any modification of the streambed, bank or channel requires notification to CDFG under the Lake or Streambed Alteration program. For all projects that do not meet the requirement of standard exemptions, project review under CEQA is likely to be necessary.

- Pre-project photo monitoring data (per CDFG's guidelines).
- Project Description:
    - Project problem statement,
    - Project goals and objectives, etc.
    - Watershed context.
    - Description of the type of project and restoration techniques utilized (culvert replacement, instream habitat improvements, etc.).
    - Project dimensions.
    - Description of Construction Activities Anticipated (types of equipment, timing, staging areas or access roads required).

- If dewatering of the work site will be necessary, description of temporary dewatering methods including qualified individual who will be onsite to transport protected salmonids.
    - Construction start- and end-dates.
    - Estimated number of creek crossings and type of vehicle.
    - Materials to be used.
    - When vegetation will be affected as a result of the project, (including removal and replacement), provide a visual assessment of dominant native shrubs and trees, approximate species diversity, and approximate acreage.
    - Description of existing site conditions and explanation of how proposed activities improve or maintain these conditions for steelhead or coho move within the natural variability needed to support these species.
    - Description of key habitat elements (i.e., temperature; type: pool, riffle, flatwater; estimate of instream shelter and shelter components; water depth; dominant substrate type, etc.) for coho and steelhead in project area.
- Description of applicable minimization and avoidance measures incorporated into the individual project.
    - Description of any proposed deviations from that authorized in the BA will be clearly described. It is likely that any proposed deviations from the activities described in the *Proposed Action* subsection (above) or the required protection measures described (above), will result in the project not being covered under this Program and would require individual consultation.
    - Individual project applicants will be required to submit a proposed monitoring plan for the project describing how they will ensure compliance with the applicable monitoring requirements described in this Program description (revegetation, etc.), including the source of funding for implementation of the monitoring plan.
    - For projects that may result in incidental take of coho; (*i.e.* that will require dewatering and fish relocation activities in a stream historically known to support coho), the applicant will also need to comply with the requirements of the California Endangered Species Act (CESA). CESA requires that impacts be minimized and fully mitigated and that funding for implementation is assured. Thus, for projects that have grant funding for implementation, the funding assurance shall be the grant/agreement itself, showing monies earmarked for implementation of necessary protection measures during implementation and follow-up monitoring, or another mechanism approved by NOAA Fisheries and CDFG in writing. For projects that have no such grant funding, the applicant shall be required to provide security in the form of an Irrevocable Letter of Credit issued by a bank or other financial institution giving CDFG access to an account set up with the security deposit in an amount approved in writing by NOAA Fisheries and CDFG. The funding security will be held until the required measures have been successfully implemented.
    - The applicant will sign a “checklist” of project conditions, verifying that they are agreeing to adhere to during project design and implementation (Appendix B).

2. Post Construction Monitoring and Reporting Requirements

Implementation monitoring will be conducted for all projects implemented under the proposed Program. Following construction, individual applicants will submit a post-construction, implementation report to the NOAA RC and the Corps. The implementation report will also be sent to CDFG. Submittal requirements will include project as-built plans describing post implementation conditions and photo documentation of project implementation taken before, during, and after construction utilizing CDFG photo monitoring protocols. For fish relocation activities, the report will include: all fisheries data collected by a qualified fisheries biologist which shall include the number of listed salmonids killed or injured during the proposed action, the number and size (in millimeters) of listed salmonids captured and removeda and any effects of the proposed action on listed salmonids not previously considered.

a. *Monitoring Requirements for Off-channel/Side Channel Habitat Features*

All off channel/side channel habitat projects included in the Program will require an additional level of physical and biological monitoring. In addition to the information collected during the pre-project monitoring and submittal requirements (above), the following information will also be collected by the Program applicants. Program applicants will submit the following information to the NOAA RC to help further understand these project types:

- Pre and post project photo monitoring data (per CDFG's guidelines)
- Project Description:
    - Project problem statement
    - Project goals and objectives, etc.
    - Watershed context
    - Description of the type of off channel feature and restoration techniques utilized
    - Project dimensions
    - Description of outlet control feature (if present)
    - If dewatering of the work site will be necessary, description of temporary dewatering methods including qualified individual who will be onsite to transport protected salmonids
    - Construction start and end dates
    - Materials to be used
    - When vegetation will be affected as a result of the project, (including removal and replacement), provide a visual assessment of dominant native shrubs and trees, approximate species diversity, and approximate acreage
    - Description of existing site conditions and explanation of how proposed activities improve or maintain these conditions for steelhead or coho salmon move within the natural variability needed to support these species

- Description of key habitat elements (*i.e.*, temperature; habitat type: pool, riffle, flatwater; estimate of instream shelter and shelter components; water depth; dominant substrate type, etc.) for coho salmon and steelhead in project area
- Pre and post (after winter flow event) information on the elevation of the inlet and outlet structure relative to the 2-year flood
- A description of if and when the off channel feature became disconnected from the main channel and at what flow level (cfs). This will require checking the project site daily when the off channel feature is becoming disconnected from the main channel
- A description of any stranded fish observed. If there are salmonids stranded, the applicant will contact NMFS PRD immediately to determine if a fish rescue action is necessary. CDFG (Gayle Garman (707) 445-6512 or Watershed Biologist Michelle Gilroy (707) 445-6493) will also be contacted with fish rescue information and/or mortalities by species

3. <u>Annual Report</u>

Annually, the TEAM will prepare a report summarizing results of projects implemented under the Program during the most recent construction season and results of post-construction implementation and effectiveness monitoring for that year and previous years. The annual report shall include a summary of the specific type and location of each project, stratified by individual project, 4th field HUC and ESU and/or DPS. The report shall include the following project-specific information:

- A summary detailing fish relocation activities, including the number and species of fish relocated and the number and species injured or killed.
- A map indicating the location of each project
- The number and type of instream structures implemented within the stream channel.
- The size (acres, length, and depth) of off channel habitat features enhanced or created.
- The length of streambank (feet) stabilized or planted with riparian species.
- The number of culverts replaced or repaired, including the number of miles of restored access to unoccupied salmonid habitat.
- The size on number of dams removed, including the number of miles of restored access to unoccupied salmonid habitat.
- The distance (feet) of aquatic habitat disturbed at each project site.

III. ANALYTICAL APPROACH

Pursuant to section 7(a)(2) of the Endangered Species Act (ESA), Federal agencies are directed to insure that their activities are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of critical habitat. This section contains the conceptual framework and key steps and assumptions utilized in the jeopardy analysis, followed by the framework proposed for the analysis of destruction or adverse modification of critical habitat.

A. Legal and Policy Framework

Section 7(a)(2) of the ESA and its implementing regulations (50 CFR Part 402), and associated guidance documents (*e.g.*, Endangered Species Consultation Handbook 1998) require biological opinions to present: (1) a description of the proposed federal action, (2) a summary of the status of the affected listed species and designated critical habitat, (3) a summary of the environmental baseline within the action area, (4) a detailed analysis of the effects of the Proposed Action on the affected species and critical habitat, (5) a description of cumulative effects (future non-federal actions that are reasonably certain to occur), and (6) a conclusion as to whether the Proposed Action is likely to jeopardize the continued existence of the listed species or likely to result in the destruction or adverse modification of the designated critical habitat of the listed species. By regulation (50 CFR § 402.02), the "effects of the action" include the direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action that will be added to the environmental baseline. 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, consideration is given to the combination of the status of the species and critical habitat, the effects of the action, and the cumulative effects of reasonably certain to occur non-federal actions. An action that is likely to *jeopardize the continued existence* of the listed species is one that is 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). In this opinion, NMFS makes this evaluation of extinction risk and its relationship to the legal standard "likelihood of both survival and recovery" and the best available scientific information relating to viable salmonid populations (McElhany et al. 2000) as described in the *Ecological Conceptual Framework* below.

B. Ecological Conceptual Framework

We used a conceptual model of the species to evaluate the effects of the Project. For this consultation, the conceptual model is structured and described around listed SONCC coho salmon (although the model is also applicable to and used for Chinook salmon and steelhead in the action area of the Program). In this consultation the conceptual model is based on a hierarchical organization of individual fish, population unit, and evolutionarily significant unit (ESU). 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 in the species (organized by diversity strata[2] that comprise that species), and the likelihood of survival and recovery of each population unit is dependent upon the fitness (lifetime reproductive

2 Diversity strata are defined as groups of populations that span the diversity of environments and distribution that currently exists or historically existed within the ESU.

success) of the individuals that comprise that population.

A prerequisite for predicting the effects of a proposed action on a population/species includes an understanding of the condition of the population/species in terms of their probability of surviving and recovering. To do this, we assessed their chances of recovery given their condition and threat regime during the period of project effects. Viability is defined as "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. Importantly, a viable population (or species) is not necessarily one that has recovered as defined under the ESA. To meet recovery standards, the species may need to achieve higher levels of resiliency to allow for activities such as commercial harvest and the existing threat regime would need to be abated or ameliorated as detailed in a recovery plan. As a result, we evaluate the current status of the species to diagnose how near, or far, the species is from this viable state because it is an important metric indicative of a self-sustaining species in the wild, but we also consider the ability of the species to recover in light of its current condition and the status of the existing and future threat regime. Generally, NMFS folds this consideration of current condition and ability to recover into a conclusion regarding the "risk of extinction" of the populations or species. We equated the risk of extinction of the species 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. Our jeopardy assessment, therefore, focused on whether a proposed action appreciably increased extinction risk, which is a surrogate for appreciable reductions in the likelihood of both the survival and recovery of the species in the wild.

We adopted the general life cycle approach outlined by McElhany et al. (2000) and used the Viable Salmonid Populations (VSP) concept as an organizing framework in this consultation. We used the VSP concept to systematically examine the complex linkages of project effects on viability while also addressing key risk factors such as climate change and ocean condition. 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 of coho salmon and are used to evaluate the risk of extinction of the SONCC coho salmon ESU (McElhany et al. 2000). The first three parameters are consistent with and are used as surrogates for the "reproduction, numbers, or distribution" criteria found within the regulatory definition (50 CFR § 402.02) of *jeopardize the continued existence…* (*i.e.*, jeopardy). The fourth VSP parameter, diversity, relates to all three jeopardy criteria. For example, 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.

C. Risk Assessments

As described above, the regulations implementing section 7(a)(2) of the ESA direct us to assess proposed project effects on the ESU in order to determine whether the proposed project is likely to jeopardize the listed species. Generally, we first identified the environmental “stressors” (physical, chemical or biotic) directly or indirectly caused by the Project to which coho salmon are expected to be exposed to, the nature of the exposure, and the life stages that would be exposed. Next, we evaluated the likely response of coho salmon to such stressors based on the best scientific and commercial information available, including observations of how past similar exposures has affected the species. We then examined the effects of hydrological modifications to individuals of the species given the physical, chemical, or biotic needs of coho salmon in the action area. We assessed whether the conditions that result from the Project, in combination with conditions influenced by other past and ongoing activities and natural phenomena as described in the Environmental Baseline, will affect the growth, survival, or reproductive success of individual coho salmon.

D. Jeopardy Assessment Approach

Our jeopardy assessment begins with a diagnosis of the current status of the SONCC coho salmon ESU throughout its geographic range. In other words, NMFS evaluates the current risk of extinction of the SONCC coho salmon ESU given its exposure to human activities and natural phenomena throughout its geographic distribution. As discussed above, NMFS utilizes the VSP conceptual framework for this assessment. The diagnosis describes the species status, identifies existing threats, and details the distribution and trends of threats throughout the range of the SONCC coho salmon ESU. We describe the status of the species at the ESU or DPS scales in terms of the VSP parameter and the diversity strata within the ESU that are expected to be affected by the Project. In addition, we consider the effects of climate change and the influence of ocean condition on the species. Because NMFS’ opinion as to whether an action is likely to jeopardize a species is based on the species-as-listed scale (ESU for coho salmon), the SONCC coho salmon diagnosis presented in the *Status of the Species* section of this opinion provides a point-of-reference that NMFS uses in its final steps in the jeopardy analysis within the *Integration and Synthesis* section.

Our jeopardy risk assessment continues with the Environmental Baseline, which is designed to assess the current risk of extinction of coho salmon population units at the scale of the action area given their exposure to human activities and natural phenomena. As specified under section 7 regulations, 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. The Environmental Baseline of this Opinion identifies the antecedent conditions, including those that likely have resulted from past projects, on individual coho salmon and the viability parameters of coho salmon populations at the action area scale. Because our jeopardy analysis must consider the effects of the Project within the context of the other impacts experienced by the species, some information provided in the Environmental

Baseline is also used to describe the conditions faced by the same individuals that will be affected by the Project. NMFS uses the analysis of how activities other than Project activities have impacted the fitness of individual coho salmon to provide the context or condition of the animals that the proposed Project will impact from now until 2015.

In the *Effects of the Action* section, NMFS evaluates the likely effects of the Project to coho salmon within the action area. We use the stressor, exposure, and response framework described above to identify the probable risks that individual coho salmon will likely experience as a result of the Project.

Once the fitness of individual coho salmon is determined, the next steps in NMFS' jeopardy assessment are to evaluate whether these fitness consequences are reasonably likely to result in changes in the risk of extinction of coho salmon populations in the action area. We complete this assessment by relying on the information available about the species and the specific population units in terms of current and needed levels of abundance, productivity, diversity, and spatial structure characteristics, as presented in the *Status of the Species* and *Environmental Baseline* sections. For example, lower survival resulting from loss or reduction of rearing habitat may reduce abundance. This same reduction can reduce the productive capacity of the river system and impact the productivity of the population, or constrain the ability of individuals of the species to track environmental changes, affecting the diversity and spatial structure of the population. If a population unit is at high risk of extinction due to the current condition of one or more of these characteristics, negative impacts to those same vulnerable characteristics are more likely to increase appreciably the risk of extinction of a population unit. Impacts to less vulnerable characteristics or to a population unit facing a low risk of extinction (generally, a higher likelihood of being at or near a viable state) are less likely to increase the population's risk of extinction.

NMFS may conclude that an action is likely to jeopardize the species through one or more of at least two mechanisms: (1) increases in the risk of extinction of the species or (2) decreases in the chance that the species can become viable or recovered. Increases in the extinction risk of the species are considered appreciable reductions in the likelihood of both survival and recovery of the species. Conversely, if no increases in a population unit's risk of extinction are expected, we could conclude that the ESU is not appreciably affected by the Project.

In our jeopardy risk assessment for the species, we relied on Williams et al. (2008) for demographic viability criteria. The viability objective at the ESU level is that all diversity strata be viable. Ultimately, the viability of the ESU depends on the extinction risk of its constituent populations. As stated in Williams et al. (2008) "the ability of populations to function in an integrated manner and persist across the landscape creates the foundation of ESU viability." This integration is based on connectivity among populations (through dispersal) and a diverse set of habitats that allow for the expression of various life history types (Williams and Reeves 2003). By requiring all diversity strata be viable, there is a greater chance that the range of historical environmental conditions will be represented and therefore, a greater chance that the range of historical diversity within the ESU will be represented. Viable strata also helps ensure that an ESU persists throughout most of its historical range, and that there is connectivity across the ESU.

E. Destruction or Adverse Modification Determination

This biological opinion does not rely on the regulatory definition of destruction or adverse modification of critical habitat at 50 CFR 402.02[3]. Instead, we have relied upon the statutory provisions of the ESA to complete the following analysis with respect to critical habitat. The basis of the "destruction or adverse modification" analysis is to evaluate whether the proposed action results in negative changes in the function and value of the critical habitat in the conservation of the species. Therefore, NMFS bases the critical habitat analysis on the affected areas and functions of critical habitat essential for the conservation of the species (not on how individuals of the species will respond to changes in habitat quantity and quality).

For purposes of the destruction or adverse modification determination, we add the effects of the proposed Federal action on designated critical habitat in the action area, and any cumulative effects, to the environmental baseline and then determine if the resulting changes to the conservation value of critical habitat in the action area are likely to cause an appreciable reduction in the conservation value of critical habitat ESU/DPS-wide. Similar to the hierarchical approach used above, if the proposed action will negatively affect the primary constituent elements (PCEs) of critical habitat in the action area we then assess whether the conservation value of the stream reach or river, larger watershed areas, and whole watersheds will be reduced. If these larger geographic areas are likely to have their critical habitat value reduced, we then assess whether or not this reduction will impact the conservation value of the DPS or ESU critical habitat designation as a whole.

F. Use of Best Available Scientific and Commercial Information

To conduct the assessment, NMFS examined an extensive amount of information from a variety of sources. Detailed background information on the biology and status of the listed species and critical habitat has been published in a number of documents including peer reviewed scientific journals, primary reference materials, and governmental and non-governmental reports. Additional information regarding the effects of the proposed action on the listed species and the environmental consequences of the actions as a whole was formulated from the aforementioned resources, the years of monitoring reports for the Grant Program, and applicable project meeting notes. A complete copy of the administrative record is kept at the NOAA, NMFS, SWR Northern California Office, in Arcata, California.

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3 This regulatory definition was invalidated by Federal Courts (*Gifford Pinchot Task Force* v. *U.S. Fish and Wildlife*, 378 F.3d 1059 [9th Cir. 2004] and *Sierra Club* v. *U.S. Fish and Wildlife Service*, 245 F.3d 434 [5th Cir. 2001]).

IV. STATUS OF THE SPECIES

This biological opinion analyzes the effects of the proposed action on the following listed species and their designated critical habitats:

Southern DPS of Pacific Eulachon
(*Thaleichthys pacificus*)
Threatened (75 FR 13012, March 18, 2010)

Southern Resident Killer Whales DPS
(*Orcinus orca*)
Endangered (70 FR 69903, November 18, 2005)

Southern DPS of North American Green Sturgeon
(*Acipenser medirostris*)
Threatened (71 FR 17757, April 7, 2006)
Designated critical habitat (74 FR 52300, October 9, 2009)

Threatened SONCC coho salmon (*Oncorhynchus kisutch*)
Listing determination (70 FR 37160; June 28, 2005)
Critical habitat designation (64 FR 24049; May 5, 1999)

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

Threatened NC steelhead (*O. mykiss*)
Listing determination (71 FR 834; January 5, 2006)
Critical habitat designation (70 FR 52488; September 2, 2005)

As mentioned earlier in this opinion, NMFS concluded that the project, as proposed, is not likely to adversely affect southern DPS of Pacific Eulachon, southern DPS of Green Sturgeon, or Southern Resident Killer Whales; or designated critical habitat for Southern eulachon, or Southern Green Sturgeon. These species or their critical habitat will not be discussed further in this biological opinion.

In this opinion, NMFS assesses the status of SONCC coho salmon, CC Chinook salmon, and 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 quantitatively, NMFS has used existing information to determine the general condition of each population and factors responsible for the current status of each ESU.

Table 2 summarizes 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 Assessment.

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

A. Species Life History, Distribution, and Abundance

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

1. <u>NC Steelhead</u>

a. Life History

Steelhead 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, and 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, albeit with limited data, that: (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. <u>CC Chinook Salmon</u>

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 oversummer 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-run Chinook salmon are found spawning farther south. NMFS identified four regions of this portion of the California coast with similar basin-scale environmental and ecological characteristics (Bjorkstedt et al. 2005). In these four regions, 16 watersheds were identified that have a 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 salmon stocks, while the Lower Eel and Van Duzen rivers have the potential to be independent. Chinook salmon are observed annually in the Middle Fork Eel River, in Black Butte River, and near Williams Creek. Chinook salmon are also 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. All of these independent populations in the North Coastal Region still contain extant populations, but at much reduced abundance and distribution than historically. In the *North-Central Coastal Region*, numerous watersheds in Mendocino County contain 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 Chinook salmon 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 (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 (70 FR 37160, Good et al. 2005).

Good et al. (2005) found that historical and current information indicate that CC Chinook salmon populations have declined. Low abundance, introduction of hatchery fish, and reduced distribution continues to substantially contribute to risks facing this ESU.

3. <u>SONCC Coho Salmon</u>

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 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 2), 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 2). 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.

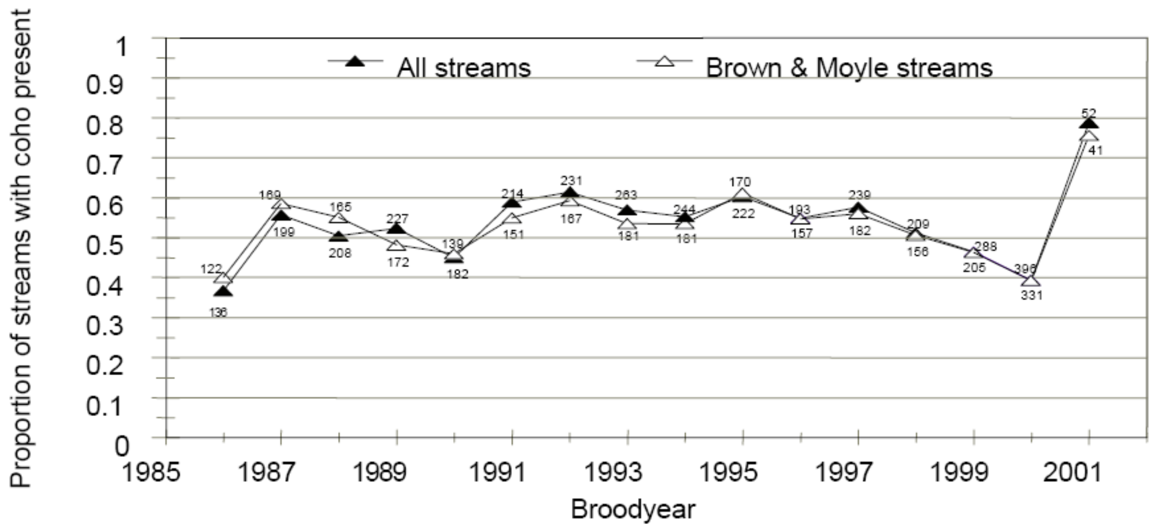

Figure 2. Proportion of surveyed streams where coho salmon were detected (Good et al. 2005). The number of streams surveyed are identified next to data.

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. <u>Timber Harvest</u>

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 provides a critical element in the habitat of aquatic life forms (Spence et al. 1996, Reid 1998). Sullivan et al. (1987) found that woody debris forms abundant storage sites for sediment in forest streams as large as fourth-order (20 to 50 km^2 drainage area), where storage is otherwise limited by steep gradients and confinement of channels between valley walls. Studies of this storage function in Idaho by Megahan and Nowlin (1976) and in Oregon by Swanson and Lienkamper (1978) indicated that annual sediment yields from small forested watersheds are commonly less than 10 percent of the sediment stored in channels.

In fish-bearing streams, 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 timeframe, 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, Swanston and Swanson 1976, Reid and Dunne 1984, Hagans and Weaver 1987). Once constructed, existing road networks are a chronic source of sediment to streams (Swanston 1991) and are generally considered the main cause of accelerated surface erosion in forests across the western United States (Harr and Nichols 1993). Processes initiated or affected by roads include landslides, surface erosion, secondary surface erosion (landslide scars exposed to rainsplash), and gullying. Roads and related ditch networks are often connected to streams via surface flow paths, providing a direct conduit for sediment. 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).

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

Normally, predators play an important role in the ecosystem, culling out unfit individuals, thereby strengthening the species as a whole. The increased 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 percent; Bartholomew 2005). Adults in the Klamath basin are also largely impacted by disease, primarily from the common pathogens *Ichthyopthirius multifilis* (Ich) and *Flavobacterium columnare* (columnaris) (NRC 2003). 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. Commercial and Recreational Fisheries

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 morality 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 seven percent 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 percent on Rogue/Klamath hatchery coho salmon (surrogate stock) and no retention of coho salmon in California ocean fisheries. Only marked hatchery coho salmon are allowed to be harvested in the Rogue and Klamath rivers. All other recreational coho salmon fisheries in the Oregon portion of the ESU are prohibited. 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 (Moyle et al. 2008). 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 percent 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. <u>Climate Change</u>

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. <u>Ocean Conditions</u>

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 (McFarlane 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. <u>Marine Derived Nutrients</u>

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

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). Viable salmonid populations are described in terms of four parameters: abundance, population productivity, spatial structure, and diversity. These parameters are predictors of extinction risk, and reflect general biological and ecological processes that are critical to the growth and survival of salmon (McElhany et al. 2000). Because some of the parameters are related or overlap, the evaluation is at times necessarily repetitive. Viable ESUs are defined by some combination of multiple populations, at least some of which exceed “viable” thresholds, and that have appropriate geographic distribution, protection from catastrophic events, and diversity of life histories and other genetic expression.

VSP Parameter 1: Population Size

Information about population size provides an indication of the type 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 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."

VSP Parameter 2: Population Productivity

The productivity of a population (i.e., production over the entire life cycle) 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). In general, declining productivity equates to declining population abundance. 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).

VSP Parameter 3: 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."

VSP Parameter 4: 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 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).

1. <u>NC Steelhead DPS</u>

a. *Population Abundance of 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 that "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.

b. Productivity of NC Steelhead

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.

c. Spatial Structure of 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.

d. Diversity of 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 10 years, more than one-half million yearlings were reared and released in this way. This practice may have reduced the effectiveness of adult homing to the Eel River (Bjorkstedt et al. 2005). In addition, the abundance of summer-run steelhead 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.

e. Summary of NC Steelhead DPS Viability

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. <u>CC Chinook Salmon ESU</u>

a. *Population Abundance of CC Chinook*

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.

b. *Productivity of CC Chinook*

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.

c. *Spatial Structure of CC Chinook*

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.

d. *Diversity of CC Chinook*

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.

e. *Summary of CC Chinook ESU Viability*

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. <u>SONCC Coho Salmon ESU</u>

In order to determine the current risk of extinction of the SONCC coho salmon ESU, the population viability criteria and the concept of Viable Salmonid Populations (VSP) for evaluating populations described by McElhany et al. (2000) are utilized. A viable salmonid population is defined as one that has a negligible risk of extinction over 100 years. Viable salmonid populations are described in terms of four parameters: abundance, population productivity, spatial structure, and diversity. These parameters are predictors of extinction risk, and reflect general biological and ecological processes that are critical to the growth and survival of salmon (McElhany et al. 2000).

a. *Population Abundance of SONCC Coho Salmon*

Quantitative population-level estimates of adult spawner abundance spanning more than 9 years are scarce for SONCC coho salmon. New data since publication of the previous status review (Good et al. 2005) consists of continuation of a few time series of adult abundance, expansion of efforts in coastal basins of Oregon to include SONCC coho salmon populations, and continuation and addition of several "population unit" scale monitoring efforts in California. Other than the Shasta River and Scott River adult counts, reliable current time series of naturally produced adult spawners are not available for the California portion of the SONCC ESU at the "population unit" scale.

Although long-term data on coho salmon abundance are scarce, the available monitoring data indicate that spawner abundance has declined for populations in this ESU. The longest existing time series at the population unit scale is from the past ten years for Shasta River (Figure 3), which has a significant negative trend. Available time series data on the Shasta River show low adult returns, of which two out of three cohorts are considered to be nearly extirpated (Chesney et al. 2009). The Shasta River population has declined in abundance by almost 50 percent from one generation to the next (Williams et al. 2011).

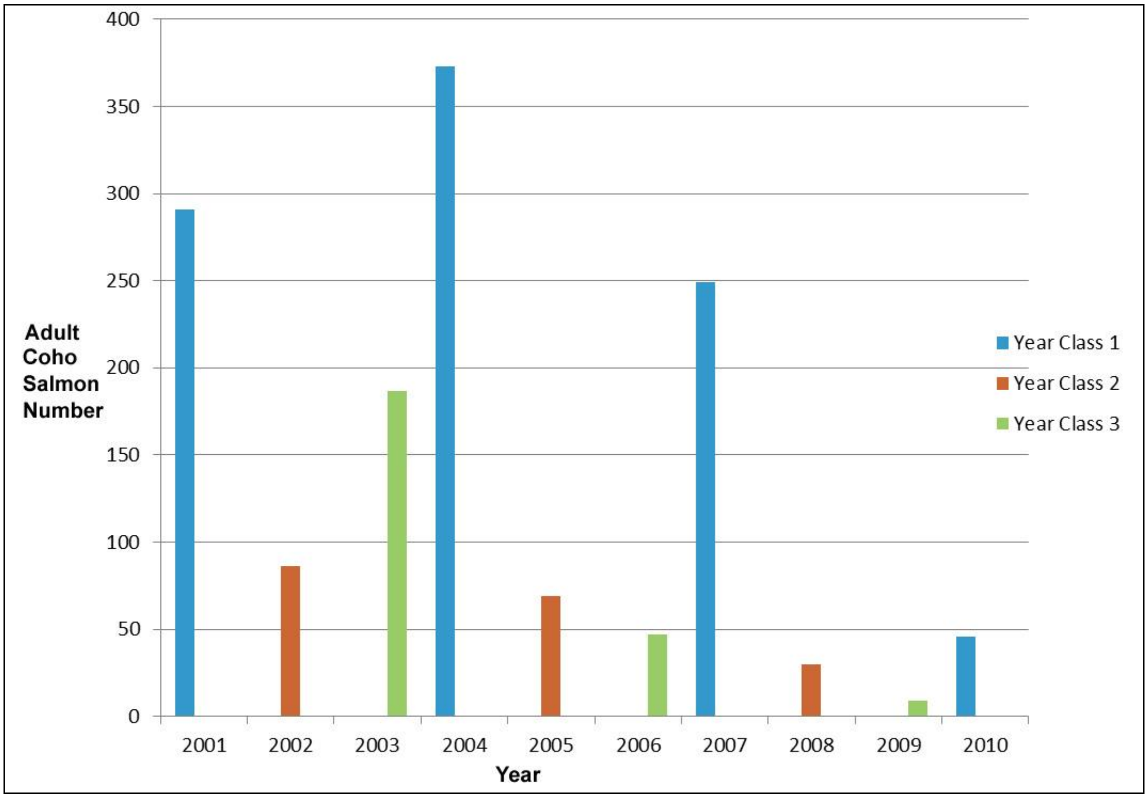

Figure 3. Video weir estimates of adult coho salmon in the Shasta River from 2001 through 2010 (from M. Knechtle, CDFG).

Two partial counts from Prairie Creek, a tributary of Redwood Creek; and Freshwater Creek, a tributary of Humboldt Bay show negative trends (figures 4 and 5, respectively). Data from the Rogue River basin also indicate recent negative trends. Estimates from Huntley Park in the Rogue River basin show a strong return year in 2004, followed by a decline to 394 fish in 2008, the lowest estimate since 1993 and the second lowest going back to 1980 in the time series (figure 6). The Huntley Park seine estimates provide the best overall assessment of naturally produced coho salmon spawner abundance in the basin (Oregon Department of Fish and Wildlife (ODFW) 2005). Four independent populations contribute to this count (Lower Rogue River, Illinois River, Middle Rogue and Applegate rivers, and Upper Rogue River). The 12-year average estimated wild adult coho salmon in the Rogue River basin between 1998 and 2009 to be 7,414 adults, which is well below historic abundance. Based on extrapolations from cannery pack, the Rogue River had an estimated adult coho salmon abundance of 114,000 in the late 1800s (Meengs and Lackey 2005).

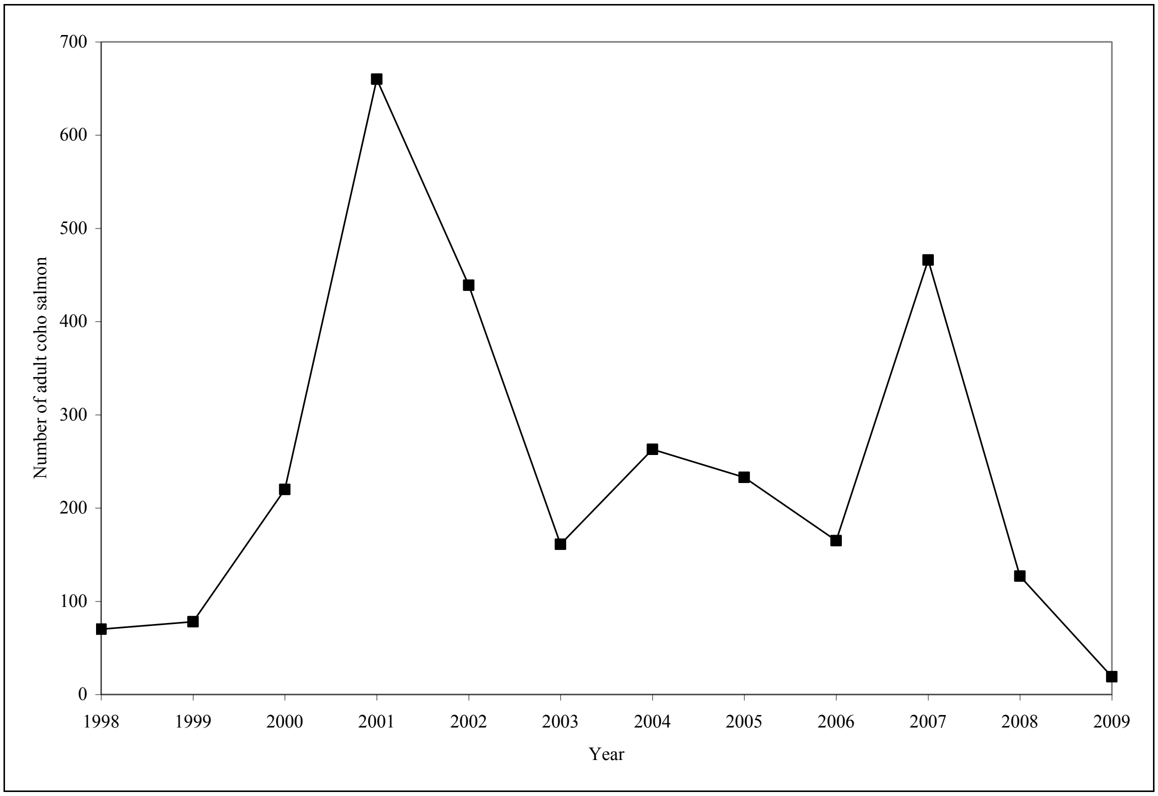

Figure 4. Estimate of spawning coho salmon in Prairie Creek from 1998 through 2009, a tributary to Redwood Creek, Humboldt County, California (Williams et al. 2011).

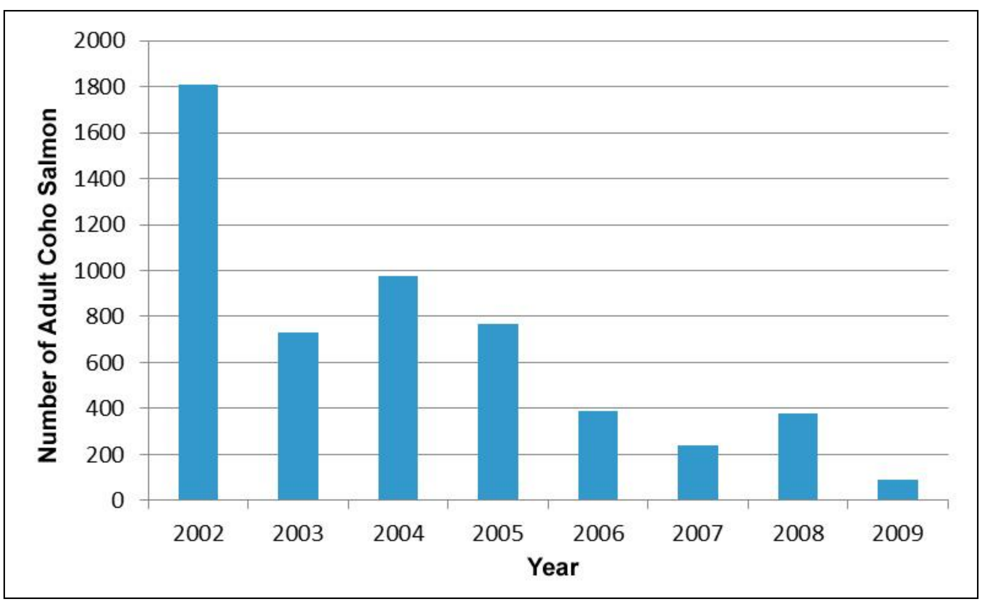

Figure 5. Estimated adult coho salmon returns to Freshwater Creek from 2002 through 2009, a tributary to Humboldt Bay (Ricker and Anderson 2011).

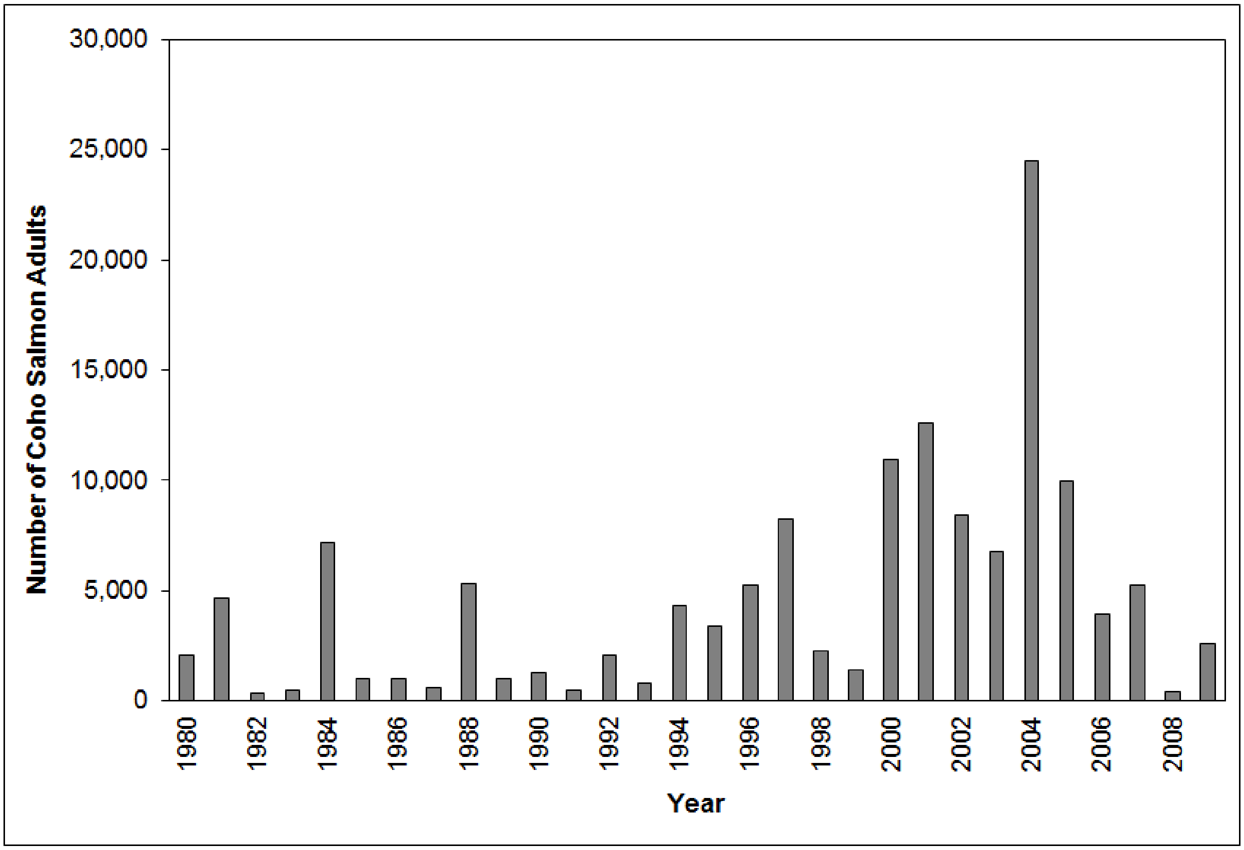

Figure 6. Estimated number of wild adult coho salmon in the Rogue River basin from 1980 through 2009. (Huntley Park sampling, ODFW 2010).

Though population-level estimates of abundance for most independent populations are lacking, the best available data indicate that none of the seven diversity strata appears to support a single viable population as defined by in the viability criteria. In fact, most of the 30 independent populations in the ESU are at high risk of extinction because they are below or likely below their depensation threshold.

Sharr et al. (2000) modeled the probability of extinction of most Oregon Coast natural populations and determined that as spawner density dropped below 4 fish per mile (2.4 spawners/km), the risk of extinction rises rapidly (Figure 7). When Chilcote (1999) tracked the collapse of four coho salmon populations in the Lower Columbia River, they found the depensation threshold was 2.4 spawners/km. Using spawner-recruit relationships from 14 populations of coho salmon, Barrowman et al. (2003) found evidence of depensatory effects when spawner densities are less than 1 female per km (2 spawners/km). Small-population demographic risks are very likely to be significant when spawner density is below 0.6 spawner per km (Wainwright et al. 2008), which Williams et al. (2008) estimates is approximately 1 spawner/IP-km and used this density for setting the depensation threshold. Because the depensation threshold for SONCC coho salmon populations is set at such a low density, populations that do not meet their depensation threshold are definitely at a high, if not a very high, risk of extinction.

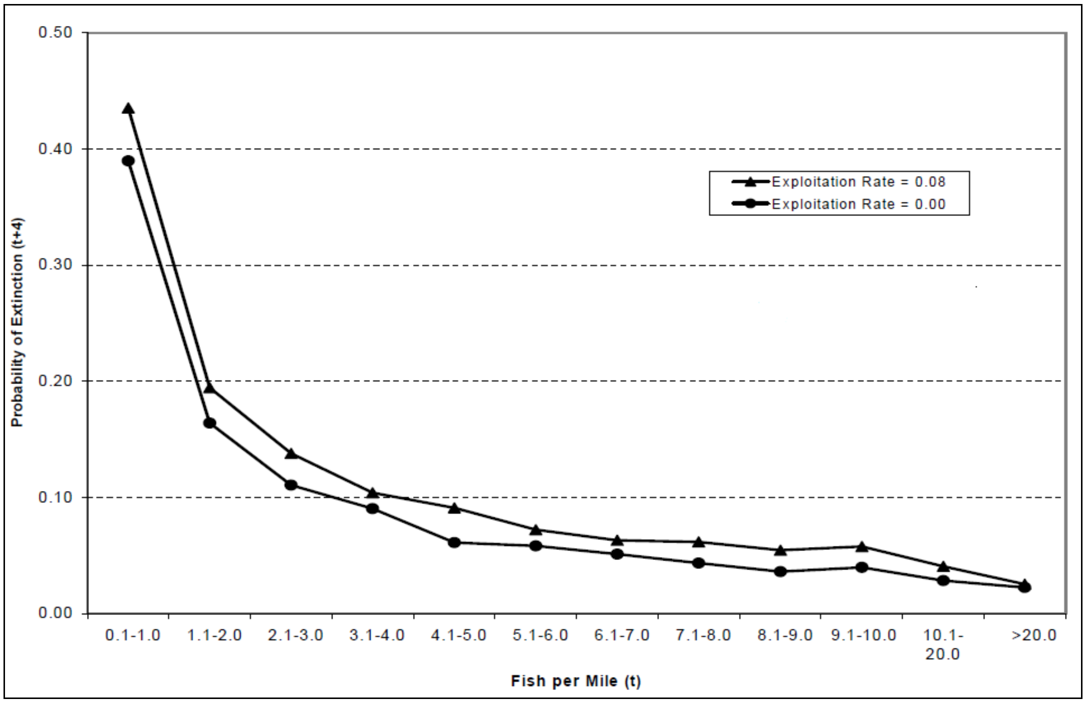

Figure 7. Probability of basin-level extinction of coho salmon populations in all Oregon coastal basins. Probability applies to four generations as a function of spawner density for exploitation rates of 0.00 and 0.08 (Sharr et al. 2000).

In addition, populations that are under depensation have increased likelihood of being extirpated. Extirpations have already occurred in the Eel River basin and are likely in the interior Klamath River basin for one or all year classes (*e.g.*, Shasta and Scott rivers), Bear River, and Mattole River. Coho salmon spawners in the Eel River watershed, which historically supported significant spawners (*e.g.*, 50,000 to 100,000 per year; Yoshiyama and Moyle 2010), have declined. Yoshiyama and Moyle (2010) concluded that coho salmon populations in the Eel River basin appear to be headed for extirpation by 2025. One of the four independent populations in this basin have already been extirpated (*i.e.*, Middle Fork Eel River; Moyle et al. 2008, Yoshiyama and Moyle 2010) and one population contains critically low numbers (*i.e.*, Upper Mainstem Eel River; with only a total of 7 coho salmon adults observed at the Van Arsdale Fish Station in over six decades; Jahn 2010). Although long-term spawner data are not available, both NMFS and CDFG believe the Lower Eel/Van Duzen River, Middle Mainstem Eel and Mainstem Eel river populations are very likely below the depensation threshold, and thus are at a high risk of extinction. The only population in the Eel River basin that is likely to be above its depensation threshold is the South Fork Eel River, which also has significantly declined from historical numbers (Figure 8).

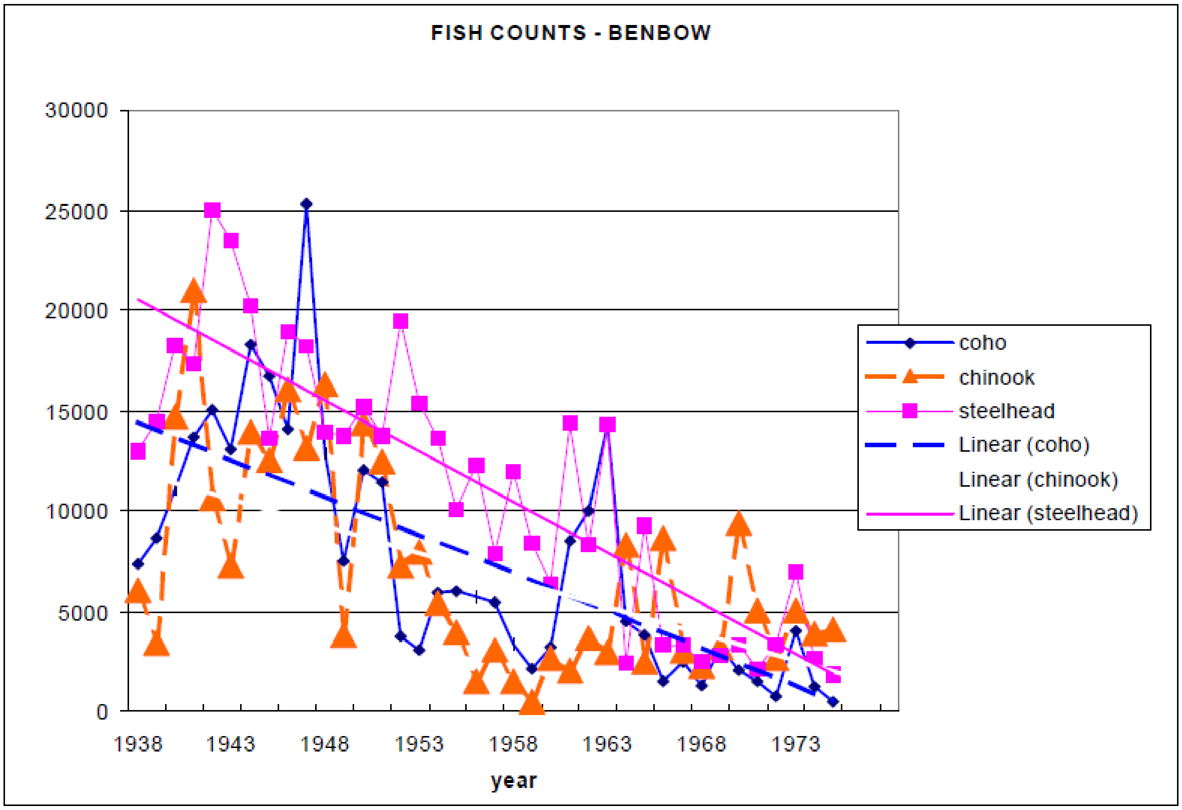

Figure 8. Fish counts at Benbow Fish Station, in the South Fork Eel River. Data are from 1938 to 1975. Graph from EPA 1999.

In addition to the Eel River basin, two other independent populations south of the Eel River basin, the Bear River and Mattole River populations, have similar trajectories. The Bear River population is likely extirpated or severely depressed. Despite multiple surveys over the years, no coho salmon have been found in the Bear River watershed (Ricker 2002, Bliesner et al. 2006). In 1996 and 2000, the CDFG surveyed most tributaries of Bear River, and did not find any coho salmon (CDFG 2004). In addition, CDFG sampled the mainstem and South Fork Bear River between 2001 and 2003 and found no coho salmon (Jong et al. 2008). In the Mattole River, surveys of live fish and carcasses since 1994 indicate the population is severely depressed and well below the depensation threshold of 250 spawners. Recent spawner surveys in the Mattole River resulted in only 3 and 9 coho salmon for 2009 and 2010, respectively. These low numbers, along with a recent decline since 2005, indicate that the Mattole River population is at a high risk of extinction.

Because the extinction risk of an ESU depends upon the extinction risk of its constituent independent populations (Williams et al. 2008) and the population abundance of most independent populations are below their depensation threshold, the SONCC coho salmon ESU is at high risk of extinction and is not viable.

b. *Productivity of SONCC Coho Salmon*

The productivity of a population (*i.e.*, production over the entire life cycle) 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). In general, declining productivity equates to declining population abundance. As discussed above in the *Population Abundance* section, available data indicates that many populations have declined, which reflects a declining productivity. For instance, the Shasta River population has declined in abundance by almost 50 percent in a single generation (Williams et al. 2011 and figure 3). Two partial counts from Prairie Creek, a tributary of Redwood Creek; and Freshwater Creek, a tributary of Humboldt Bay, show negative trends in abundance (figures 4, 5). Data from the Rogue River basin also indicate recent negative trends. In general, SONCC coho salmon have declined substantially from historic levels. Because productivity appears to be negative for most, if not all, SONCC coho salmon populations, NMFS considers this ESU to not be currently viable relative to population productivity.

c. *Spatial Structure of SONCC Coho Salmon*

The most recent status review for the SONCC coho salmon ESU concluded data were insufficient to set specific population spatial structure targets (Williams et al. 2008). In the absence of such targets, McElhany et al. (2000) suggested the following: "As a default, historical 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." An ESU persists in places where it is able to track environmental changes, and becomes extinct if it fails to keep up with the shifting distribution of suitable habitat (Thomas 1994, Williams et al. 2008). If freshwater habitat shrinks due to climate change (Battin et al. 2007), certain areas such as inland rivers and streams could become inhospitable to coho salmon, which would change the spatial structure of the SONCC coho salmon ESU, having implications for the risk of species extinction.

Data is inadequate to determine whether the spatial distribution of SONCC coho salmon has changed since 2005. In 2005, Good et al. (2005) noted that they had strong indications that breeding groups have been lost from a significant percentage of streams within their historical range. 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 brood year 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 lacking coho salmon runs were all tributaries of the Klamath River and Eel River basins. 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). However, the number of streams and rivers currently supporting coho salmon in this ESU has declined from historical levels, and watershed-specific extirpations of coho salmon have been documented (Brown et al. 1994, CDFG 2004, Good et al. 2005, Moyle et al. 2008, Yoshiyama and Moyle 2010). 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).

d. *Diversity of SONCC Coho Salmon*

The primary factors affecting the diversity of SONCC coho salmon appear to be low population abundance and the influence of hatcheries and out-of-basin introductions. Although the operation of a hatchery tends to increase the abundance of returning adults (70 FR 37160; June 28, 2005), the reproductive success of hatchery-born salmonids spawning in the wild can be less than that of naturally produced fish (Araki et al. 2007). As a result, the higher the proportion of hatchery-born spawners, the lower the overall productivity of the population, as demonstrated by Chilcote (2003). Williams et al. (2008), considered a population to be at least at a moderate risk of extinction if the contribution of hatchery coho salmon spawning in the wild exceeds 5 percent. Populations have a lower risk of extinction if no or negligible ecological or genetic effects resulting from past or current hatchery operations can be demonstrated. Because the main stocks in the SONCC coho salmon ESU (i.e., Rogue River, Klamath River, and Trinity River) remain heavily influenced by hatcheries and have little natural production in mainstem rivers (Weitkamp et al. 1995, Good et al. 2005), many of these populations are at high risk of extinction relative to the genetic diversity parameter.

In addition, some populations are extirpated or nearly extirpated (*i.e.*, Middle Fork Eel, Bear, and Upper Mainstem Eel rivers) and some brood years have low abundance or may even be absent in some areas (*e.g.*, Shasta River, Scott River, Mattole River, Mainstem Eel River), which further restricts the diversity of the ESU. The ESU's current genetic variability and variation in life history likely contribute significantly to long-term risk of extinction. Given the recent trends in abundance across the ESU, the genetic and life history diversity of populations is likely very low and is inadequate to contribute to a viable ESU.

e. *Summary of SONCC Coho Salmon ESU Viability*

Though population-level estimates of abundance for most independent populations are lacking, the best available data indicate that none of the seven diversity strata appears to support a single viable population as defined by the TRT's viability criteria. Integrating the four VSP parameters into the population viability criteria, as many as 25 out of 30 independent populations are at high risk of extinction and 5 are at moderate risk of extinction (table 3).

Table 3. SONCC coho salmon independent populations and their risk of extinction.

Stratum	Independent Populations	Extinction Risk	Population Viability Metric (Williams et al. 2008)
Northern Coastal Basin	Elk River	High	Population likely below depensation threshold[1]
	Lower Rogue River	High	
	Chetco River	High	
	Winchuck River	High	
Interior Rogue River	Illinois River	High	Though likely above the depensation threshold, these populations have a precipitous decline where spawners > 500 but declining at a rate of 10% per year over the last two generations. Rogue River populations reflect data from Huntley Park counts, which represents the entire Rogue River basin.
	Middle Rogue/Applegate rivers	High	
	Upper Rogue River	High	
Central Coastal Basin	Smith River	High	Population likely below depensation threshold[1]
	Lower Klamath River	High	Population likely below depensation threshold[1]
	Redwood Creek	Moderate	Population above depensation threshold[1]
	Maple Creek/Big Lagoon	High	Population likely below depensation threshold[1]
	Little River	Moderate	Population above depensation threshold[1]
	Mad River	High	Population likely below depensation threshold[1]
Interior Klamath	Middle Klamath River	Moderate	Population above depensation threshold[1]
	Upper Klamath River	High	Population below depensation threshold[1] and hatchery fraction likely >5%
	Shasta River	High	
	Scott River	High	Population below depensation threshold[1]
	Salmon River	High	
Interior Trinity	Lower Trinity River	Moderate	Population likely above depensation threshold[1]
	South Fork Trinity River	High	Population likely below depensation threshold[1]
	Upper Trinity River	High	Though above the depensation threshold, this population's hatchery fraction >5%
South Coastal Basin	Humboldt Bay tributaries	High	Though above the depensation threshold, this population has declined within the last two generations or is projected to decline within the next two generations (based on Freshwater Creek data if current trends continue) to annual run size ≤ 500 spawners.
	Lower Eel and Van Duzen rivers	High	Population below depensation threshold[1]
	Bear River	High	
	Mattole River	High	
Interior Eel	Mainstem Eel River	High	
	Middle Mainstem Eel River	High	

Stratum	Independent Populations	Extinction Risk	Population Viability Metric (Williams et al. 2008)
	Upper Mainstem Eel River	High	
	Middle Fork Eel River	High	
	South Fork Eel River	Moderate	Population above depensation threshold[1]
[1] Based on average spawner abundance over the past three years or best professional judgment of NMFS staff.			

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

The precipitous decline in abundance from historical levels and the poor status of population viability metrics in general are the main factors behind the extinction risk faced by SONCC coho salmon. The cause of the decline is likely from ocean conditions and the widespread degradation of habitat, particularly those habitat attributes that support the freshwater rearing life-stages of the species.

D. Description and Current Condition of Critical Habitat

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. *Description SONCC Coho Salmon Critical Habitat*

Coho salmon critical habitat consists of: “the water, substrate, and adjacent riparian zone [in an ESU] . . . [below] longstanding, naturally impassable barriers (*i.e.*, natural waterfalls in existence for at least several hundred years)” (64 FR 24049, May 5, 1999). NMFS has excluded from coho salmon critical habitat designation all tribal lands in northern California and areas that are above certain dams which block access to historic habitats of listed salmonids. Critical habitat corresponds to all the water, river bed and bank areas, and riparian areas within the ESU boundaries except as noted above. Waterways include estuarine areas and tributaries. Adjacent riparian area is defined as “the area adjacent to a stream that provides the following functions: shade, sediment, nutrient, or chemical regulation, stream bank stability, and input of large woody debris or organic matter” (64 FR 24049, May 5, 1999). In other words, riparian areas are those areas that produce physical, biological, and chemical features that help to create biologically productive stream habitat for salmonids. PCEs for coho salmon critical habitat include juvenile summer and winter rearing areas, juvenile migration corridors, areas for growth and development to adulthood, adult migration corridors, and spawning areas (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.

b. Description of NC Steelhead and CC Chinook Critical Habitat

NMFS designated critical habitat for seven of the ESUs/DPSs of Pacific salmon and steelhead, including CC Chinook salmon, NC, CCC, and S-CCC steelhead in September 2005 (70 FR 52488, September 2, 2005). The method and criteria used to define critical habitat focused on identifying the biological or physical constituent elements of habitat that are essential to the conservation of the species. The aggregated physical and biological PCEs resulted from a list of specific PCEs necessary for conservation of the listed species and included all the biological and physical attributes necessary for productive systems supporting the completion of all salmonid life history stages. These specific PCEs were identified: freshwater spawning sites, freshwater rearing sites, freshwater migration corridors, estuarine areas, nearshore marine areas; and offshore marine areas. Habitat areas within the geographic range of the ESU/DPSs having these attributes and occupied by the species were considered for designation. Steelhead critical habitat was designated throughout the watersheds occupied by the ESU/DPSs. In general, the extent of critical habitat conforms to the known distribution of NC, CCC, and S-CCC steelhead in streams, rivers, lagoons and estuaries (NMFS 2005, 70 FR 52488). In some cases, streams containing steelhead were not designated because the economic benefit of exclusion outweighed the benefits of designation. Native American lands and U.S. Department of Defense lands were also excluded.

2. Conservation Value of Critical Habitat

The essential habitat types of designated critical habitat for SONCC and CCC coho salmon and PCEs of designated critical habitat for NC, CCC, and S-CCC 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 DPSs 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.

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.

3. 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 coho salmon, because critical habitat had already been designated in 1999. NMFS determined the condition of coho salmon critical habitat based on other, readily available information.

a. *Condition of NC Steelhead Critical Habitat*

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.

b. *Condition of CC Chinook Salmon Critical Habitat*

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.

c. *Condition of SONCC Coho Salmon Critical Habitat*

The condition of SONCC and CCC 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 and CCC coho salmon were listed as threatened under the ESA, and they all continue to affect this ESU. However, efforts to improve 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 1000s 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.

V. ENVIRONMENTAL BASELINE

The environmental baseline is an analysis of the effects of past and ongoing human and natural factors leading to the status of the species, its habitat, and the ecosystem in the action area. 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 action area includes all coastal anadromous California streams from Humboldt County at the Mendocino County border north to the Oregon border including Humboldt, Del Norte, Trinity and Siskiyou Counties. The area includes the following USGS 4th field HUCs: Upper Klamath, Lower Klamath, Shasta, Scott, Smith, Salmon, Trinity, South Fork Trinity, Mad-Redwood, Lower Eel, South Fork Eel, Middle Fork Eel, and Upper Eel. Urban development is found primarily on the estuaries of the larger streams, though there are some small towns and rural residences throughout the area. Forestry is the dominant land-use throughout the area, although there is some agriculture.

Native vegetation in the action area varies from old growth redwood (*Sequoia sempervirens*) forest along the lower drainages to Douglas-fir (*Pseudotsuga menziesii*) intermixed with hardwoods, to ponderosa pine (*Pinus ponderosa*) and Jeffery pine (*Pinus jefferyi*) stands along the upper elevations. Grasslands are located along the main ridge tops and south-facing slopes of the watersheds.

The action area has a Mediterranean climate characterized by cool, wet winters with typically high runoff; and dry, warm summers characterized by greatly reduced instream flows. Fog is a dominant climatic feature along the coast, generally occurring daily in the summer and not infrequently throughout the year. Higher elevations and inland areas tend to be relatively fog free. Most precipitation falls during the winter and early spring as rain, with occasional snow above 1,600 feet. The action area receives one of the highest annual amounts of rainfall in California, with a few sections averaging over 85 inches a year. Mean rainfall amounts ranges from 9 to 125 inches. Extreme rain events do occur, with over 240 inches recorded over parts of the action area during 1982/83. Along the coast, average air temperatures range from 46 °F to 56 °F. Farther inland and in the southern part of the action area, annual air temperatures are much more varied, ranging from below freezing in winter to over 100 °F during the summer months.

High seasonal rainfall on bedrock and other geologic units with relatively low permeability, erodible soils, and steep slopes contribute to the flashy nature (stream flows rise and fall quickly) of the watersheds within the action area. In addition, these high natural runoff rates have been increased by extensive road systems and other land uses. High seasonal rainfall combined with rapid runoff rates on unstable soils delivers large amounts of sediment to river systems. As a result, many river systems within the action area contain a relatively large sediment load, typically deposited throughout the lower gradient reaches of these systems.

A. Status of the Species in the Action Area

1. Smith River

There is a paucity of information with regard to salmon and steelhead populations in the Smith River and trend information is very limited. CDFG (1965) estimated escapement of Chinook salmon for Smith River drainage at approximately 15,000 fish annually. The best information regarding coho salmon abundance and trends was collected during Chinook salmon spawning surveys on an index reach of the West Branch of Mill Creek by Jim Waldvogel, Sea Grant Advisor for Del Norte County (NOAA Fisheries 2003b). The number of adult coho salmon trapped ranged from 2 (1981, 1990) to 28 (1985) fish annually, with a 23 year average of 11 adult coho salmon per year. No negative or positive trends are apparent from these data. Despite the lack of data, NOAA Fisheries suspects anadromous salmonid populations within the Smith River drainage have likely experienced declines similar to other northern California and southern Oregon coastal watersheds.

Current estimates of the abundance and distribution of the Smith River coho population are based on studies that have been conducted over the past several decades. These include a long-term data set describing salmon abundance in the West Branch and East Fork Mill Creek (McLeod and Howard 2010) since 1994. Within West Branch of Mill Creek, adult coho salmon spawner counts have ranged from a high of 175 to a low of 3 between 1994 and 2009 with decreases in numbers seen in more recent years (McLeod and Howard 2010).

Habitat conditions in the Smith River basin have been degraded by high timber harvest activities, mostly from redwood harvest on private lands in the coastal sections. Timber harvest in riparian areas has reduced the recruitment potential for LWD for decades or centuries (USFS 1995). Early logging, prior to more recent forest practice rules, removed much of the streamside vegetation, particularly along larger, more accessible channels. In many cases, regeneration within these areas is now dominated by hardwoods. Hardwood dominance has the dual effect of not providing adequately-sized wood to adjacent channels while suppressing conifer regeneration. The lack of conifer-derived woody debris is likely to persist and perhaps worsen as existing instream wood decays or is transported downstream and the adjacent stands are not capable of providing adequate replacements.

A legacy of mining roads and open pits and shafts that were used and operated in the 1850s to 1950s still exist in the North Fork Smith subbasin and in the Hardscrabble, Myrtle, Patrick, and Shelly watersheds. Many of these mining features are chronic sources of sediment since revegetation, and restoration is difficult due to the inherent harsh soil conditions of these areas. Hydraulic mining was intensive in low-gradient reaches of several tributaries, significantly altering stream channel characteristics and impacting fish habitat. Currently, the lower river is mined for aggregate material and is the primary aggregate source in Del Norte County. Removal of gravel has likely altered spawning habitat in some areas.

A widespread and aging road network continues to present a sediment hazard to channels in the Smith River basin. Additionally, hillslope landslides from timber harvest and other activities in the watershed (*e.g.*, mining) provide additional sediment. While some information suggests that the upper portions of the Smith River may be able to transport much of the sediment, lower gradient reaches may be vulnerable to the accumulation of this sediment. The Smith River basin is not currently listed as water quality impaired under section 303(d) of the CWA.

2. Klamath and Trinity Rivers

The Klamath River once supported diverse, abundant anadromous fish runs thought to number in the millions. Now, all of the anadromous fish species inhabiting the Klamath River are in a state of serious decline (Higgins et al. 1992), especially those species or stocks that depend on summer freshwater aquatic habitat, such as coho salmon, steelhead, or spring Chinook salmon.

In the Klamath River, poor water quality during the summer season is considered a major contributing factor to the decline of anadromous fish runs (Bartholow 1995). The main causative factors behind the poor water quality in the mainstem Klamath River are the large-scale water impoundment and diversion projects above Iron Gate Dam (Klamath River) and Lewiston Dam (Trinity River). Average annual runoff below Iron Gate Dam has declined by more than 370,000 acre-feet since inception of the Bureau of Reclamation's Klamath Project (National Research Council 2003), while up to 90 percent of the Trinity River flow has been annually diverted into the Sacramento River (Bureau of Land Management 1995). The large volume of water diverted from each of these basins significantly affects downstream flow levels and aquatic habitat. After analyzing both pre- and post-Klamath Project hydrologic records, Hecht and Kamman (1996) concluded that variability and timing of mean, minimum, and maximum flows changed significantly after construction of the project. Project operations tend to increase flows in October and November, and decrease flows in the late spring and summer as measured throughout the Klamath mainstem. Low summer flows within the Klamath River can increase daily maximum water temperatures by slowing flow transit rates and increasing thermal loading relative to higher flows (Deas and Orlob 1999). Moreover, further heating the already-warm, nutrient-rich water released from Iron Gate Dam typically results in poor water quality (*e.g.*, low dissolved oxygen, increased algal blooms) in the Klamath River between the dam and Seiad Valley.

Lower summer flows emanating from the Klamath Project (*i.e.*, released at Iron Gate Dam) are exacerbated by diminished inflow from many of the major tributaries to the middle Klamath River. The Shasta and Scott rivers historically supported strong populations of Chinook salmon, coho salmon, and summer-run steelhead (KRBFTF 1991). However, seasonal withdrawals for agriculture in the spring and summer months can drop stream flows by more than 100 cubic feet per second (cfs) over a 24 hour period, potentially stranding large numbers of rearing juvenile salmon and steelhead. Federal, State and local agencies are currently working with landowners in the Scott and Shasta drainages to implement minimum instream flow levels sufficient to conserve salmon and steelhead habitat.

The Klamath and Trinity rivers both contain numerous instream barriers that preclude salmon and steelhead migration into much of their historic range. Iron Gate Dam and Lewiston Dam block migratory access to the headwaters of the Klamath and Trinity rivers, respectively, while numerous smaller dams, diversions, and road crossings either block or impede adult and juvenile migration within many smaller tributaries.

Much of the middle reach of the Klamath River basin (*i.e.*, between the confluence of the Trinity River and Iron Gate Dam) and Trinity River basin is under Federal ownership and not managed for intensive timber harvest. However, the lower Klamath basin below the Trinity River confluence is largely under private ownership and categorized as industrial timberland. In general, surveys in this area indicate low amounts of LWD, and the size of LWD tends to be small, primarily one- to two-foot diameter pieces. Further, due to past logging practices and development along streams, many riparian zones tend to be dominated by alder, willow, and younger conifers (Simpson 2002). Given the current vegetation age structure and past logging history along streams, recruitment of adequately sized woody debris to many of the stream reaches is not likely to occur for several decades. Furthermore, hillslope erosion resulting from timber harvest and road building dominates many of the tributary subbasins of the lower Klamath basin. For example, harvesting over a 50-year period in Hunter Creek was estimated to be responsible for 51 percent of the observed shallow landsliding volume not attributed to road-related activities (Simpson 2002). Both the Klamath River (nutrients, organic enrichment/low dissolved oxygen, and temperature) and Trinity River (sedimentation/siltation) are listed under section 303(d) of the CWA as water quality limited (CSWRCB 2003).

3. Mad River and Redwood Creek

The Mad River and Redwood Creek watersheds have endured a long legacy of watershed disturbance. Streamside vegetation removal, channel modifications, and instream gravel extraction dating back many decades, combined with intensive upslope activities such as timber harvest and road construction, have had a significant influence on the condition of both watersheds. Furthermore, both the Mad River and Redwood Creek watersheds are section 303(d) listed for turbidity and sedimentation due to timber harvest, resource extraction, and nonpoint sources (CSWRCB 2003). A principal contributor of fine sediment is hydrologically connected road segments.

a. Mad River

Population growth rates for salmonids in the Mad River have not been quantified. The closest researchers have come to this goal is when Spence et al. (2007) described diver surveys which demonstrated the number of adult summer-run steelhead in three reaches of the Mad River declined at an average rate of 23 percent per year over two generations (from 1994 to 2002). The apparent decrease in population sizes of Mad River coho salmon, Chinook salmon, and steelhead indicates the populations are not replacing themselves.

The steelhead population in the Mad River watershed is at risk from adverse hatchery effects. 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 stock to other streams within the DPS, and attempted to cultivate a run of non-indigenous summer-run steelhead within the Mad River. CDFG ended these practices in 1996. The current operation of the Mad River Hatchery has been identified as having potentially harmful effects to wild salmon populations as well.

Williams et al. (2008) determined at least 153 coho salmon spawners are needed each year in the Mad River population to avoid depensatory effects of extremely low population sizes. The most recent information indicates that adult coho salmon returns have declined to an average of 38 adults trapped and 16 females spawned at the Mad River hatchery between 1991 and 1999 (NMFS 2005). Only a fraction of all fish ascending the Mad River enter the Mad River fish ladder and fish hatchery, therefore counts there do not capture all spawners. However, the number of adult coho returns has been so low that the overall number of spawners is almost certainly a small fraction of the number required for viability. It is therefore likely that the Mad River coho salmon population is at high risk of detrimental population effects resulting from low population size.

Habitat surveys within the Mad River watershed detail the low amount and small size of existing LWD (primarily 1- to 2-foot diameter pieces). Further, due to past logging practices and development along streams, many riparian zones tend to be dominated by alder, willow, and younger conifers (Simpson 2002). Given the current vegetation age structure and past logging history along streams, recruitment of adequately-sized woody debris to many Mad River tributaries is not likely to occur for several decades.

b. Redwood Creek

Sparkman (2010) conducted outmigrant trapping in Redwood Creek the past 11 years using two traps, one located at river mile 33 and another located at river mile 4, just upstream of where Prairie Creek converges with the mainstem Redwood Creek. From 2000 to 2006, Sparkman (2006) did not capture any out-migrating coho salmon at the upper trap, suggesting that coho salmon spawning may have had limited success for about 7 years. However, in 2007, for the first time in eight consecutive years, six young-of-the-year (YOY) coho salmon were caught at the upper trap (Sparkman 2008a, 2008b). Low numbers of juvenile coho salmon were captured at the lower trap during all nine of the study years.

Using weir and spawner counts, estimated numbers of adult coho salmon in Prairie Creek in recent years indicate mostly low to occasionally moderate numbers of returning adult coho salmon (RNSP 2006). Williams et al. (2008) estimated that the historic annual spawner abundance was about 4,900 individuals. Numbers of live fish ranged from 660 in 2001/2002 to 41 in 2009/2010 (Duffy 2010). Although there may be higher numbers of spawners in the Prairie Creek watershed, all of the available information suggests that the overall number of coho salmon in the Redwood Creek basin is low relative to modeled historic abundance.

Estimates of the historical abundance of Redwood Creek Chinook salmon range from 1,000 (Wahle and Pearson 1987) to 5,000 individuals (Good et al. 2005). Redwood Creek Chinook salmon are declining precipitously, based on seine net counts during every summer between 1997 and 2006 (Anderson 2006). Duffy (2010) believes that Chinook salmon have declined in Prairie Creek during the past 6 to 7 years of monitoring, as they have gone from 400 adults to a total of about 15 over a spawning season.

CDFG has found that large numbers of 0+ 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 2006). Sparkman (2006) described that between the years 2000 and 2006, there has been a negative trend in juvenile smolt production.

Logging, road building, and the construction and maintenance of flood control levees are the land uses that have had the most pronounced effect on coho salmon habitat in the Redwood Creek basin. Much of the upper and middle portions of the basin are owned by private timber companies and are used for timber production. In addition, livestock grazing occurs on some private lands, both in the middle and upper portions of the basin and in the valley bottom near Orick, where the grazing land is protected by flood control levees.

The Redwood Creek watershed, although naturally prone to extensive storm-induced erosional events, has also experienced accelerated erosion due to land management activities (RNSP 2002). Increased mass wasting and fluvial erosion have overwhelmed the stream channel's ability to efficiently move the delivered sediment, filling deep pools and depositing silt in spawning gravels used by salmonids. The Environmental Protection Agency (EPA 1998) estimates that on average, approximately 4,750 tons of sediment per square mile are produced from the Redwood Creek watershed. The EPA also estimated that 60 percent of this sediment is controllable (*i.e.*, discharges and depositions resulting from human activities that can influence water quality and can be reasonably controlled) and must be eliminated to meet instream targets. Much observed erosion is associated with an extensive road network (7.3 miles of road per square mile of land) on private lands, improperly designed and maintained roads and skid trails, and timber harvest. Accelerated erosion from land use practices and other causes are impacting the migration, spawning, reproduction, and early development of cold-water anadromous fish such as coho salmon, Chinook salmon, and steelhead.

4. Eel River

Fishery data indicate depressed or declining abundance trends, yet observational data indicate natural populations still persist in the Eel River, albeit at low levels. Historic land and water management, specifically large-scale timber extraction and water diversion projects, contributed to a loss of habitat diversity within the mainstem Eel River and many of its tributaries. The Eel River is listed under section 303(d) of the CWA as water quality limited due to excessive sediment and high water temperatures (CSWRCB 2003). Essential habitat feature limitations include high water temperatures, low instream cover levels, high sediment levels, and low LWD abundance.

Coho salmon are no longer present, or present in such low numbers that they have not been recently observed in most populations within the Eel River. The coho salmon populations in the Middle Fork Eel River and North Fork Eel River have likely been extirpated, while other populations (Upper Mainstem Eel, Middle Mainstem Eel, and Mainstem Eel River) are likely functionally extinct based upon a lack of detections, or extremely low numbers of individuals over a long period of time. The South Fork Eel River and Lower Eel River/Van Duzen populations of coho salmon are the only populations likely to have sufficient spawner densities to avoid depensatory effects of low population sizes.

Water diversion within the Eel River basin has occurred since the early 1900s at the Potter Valley facilities. Annually, about 160,000 acre-feet (219 cfs average) are diverted at Cape Horn Dam, through a screened diversion, to the Russian River basin. Flow releases from the Potter Valley facilities have both reduced the quantity of water in the mainstem Eel River, particularly during summer and fall low-flow periods, as well as dampened the within-year and between-year flow variability that is representative of unimpaired watersheds. These conditions have restricted juvenile salmonid rearing habitat, impeded migration of adult fish and late emigrating smolts, and provided ideal low-flow, warm water conditions for predatory Sacramento pikeminnow (*Ptychocheilus grandis*; NOAA Fisheries 2002).

Intensive timber extraction within the lower Eel and Van Duzen watersheds has caused chronic erosion in certain areas due to the highly erodible soils common throughout the two watersheds. An extensive study of sediment discharge within the Eel River watershed (Brown and Ritter 1971) determined that the suspended sediment discharge increases downstream, unlike most rivers. The average annual suspended sediment load is 10,000 tons per square mile (Brown and Ritter 1971), which is one of the highest measured sediment yields in the world. As discussed previously, high levels of suspended sediment can negatively affect salmonid populations by degrading essential freshwater habitat as well as reducing fitness of individual fish and modifying behavior.

The South Fork Eel River provides suitable habitat for Chinook salmon, coho salmon and steelhead. Existing conditions indicate that the South Fork Eel River has limited rearing habitat due to elevated water temperatures. Cool water seeps, thermal stratification, and habitat complexity all play critical roles in sustaining micro-habitat for juvenile and adult salmonids. Spawning habitat is present and actively used, as indicated by redd observations in the Cooks Valley area. Fishery data indicate that individual natural populations of anadromous salmonids persist at low levels in the South Fork Eel River.

The Van Duzen River watershed reflects a long legacy of upstream and upslope impacts coupled with the effects of continued instream disturbances. Much of the available salmonid habitat within the Van Duzen watershed is currently degraded by high levels of sediment, low pool density, high water temperatures, and low instream cover levels. The Van Duzen River is listed under section 303(d) of the CWA as water quality limited due to excessive sediment (CSWRCB 2003).

5. <u>Mattole River</u>

Surveys of live fish and carcasses since 1994 indicate the coho salmon population is severely depressed and well below the modeled depensation threshold of 250 spawners. Recent spawner surveys in the Mattole River resulted in only 3 and 9 coho salmon for 2009 and 2010, respectively. It is likely that the Mattole River has extremely low numbers in some brood year classes or perhaps some may have been extirpated altogether. Given the small numbers of adults returning, the Mattole River population is approaching functional extirpation. These low numbers, along with a recent decline since 2005, indicate that the Mattole River coho salmon population is at a high risk of extinction.

Although several factors have contributed to the decline of anadromous salmonid populations in the Mattole River drainage, habitat loss and modification are major determinants of their current status (FEMAT 1993). Large-scale changes to the Mattole River occurred in response to the 1955 and 1964 floods, which coincided with peak years of logging and road building in the basin. The Mattole watershed has the second highest estimated erosion rate in northern California, second only to the Eel River (Griggs and Hein 1980), and is highly sensitive to human-induced disturbances within upper reaches of the watershed.

Logging practices in the Mattole River watershed were identified as the "specific critical habitat problem" in a status review by Myers et al. (1998). There were an estimated 3,310 miles of active and abandoned roads in the Mattole River watershed (Perala et al. 1993), and the combined effects of these roads may be the single largest source of fine sediment delivered to the Mattole River. Estuary habitat, a crucial link in the lifecycle of Pacific salmonids, has been reduced by excessive sedimentation, which has also resulted in higher water temperatures and adverse impacts to food resources. Likewise, elevated summer water temperatures within the mainstem as well as many tributaries are also a primary limiting factor for salmonids rearing in the Mattole River. The Mattole River is listed under section 303(d) of the CWA as water quality limited due to temperature, turbidity, and sedimentation (CSWRCB 2003).

VI. EFFECTS OF THE PROPOSED ACTION

Of the proposed restoration project types, several are expected to have only beneficial effects to listed species. Many of the water conservation projects occur beyond a diversion point (barrier to fish), not interacting with fish or their habitat and provide benefits by increasing instream water availability. Riparian habitat restoration actions occur outside of the wetted channel having only wholly beneficial effects to fish and their habitat. The following components of the proposed action will not be considered in the following analysis due to their expected insignificant, discountable, or wholly beneficial effects: riparian habitat restoration, development of alternative stockwater supply, tailwater collection ponds, water storage tanks, and piping ditches.

A. Insignificant or Discountable Effects to Listed Species or Their Critical Habitat

The remaining seven proposed project types may adversely affect listed species; however, some components of the projects also may result in effects, such as habitat disturbance from heavy equipment operation, riparian vegetation disturbance, chemical contamination, and reduced benthic macroinvertebrate production that are not likely to adversely affect listed species or their critical habitats. These effects are expected to be insignificant or discountable as explained further below.

1. <u>Noise, Motion, and Vibration Disturbance from Heavy Equipment Operation</u>

Noise, motion, and vibration produced by heavy equipment operation is expected at most instream restoration sites. However, the use of equipment, which will occur primarily outside the active channel, and the infrequent, short-term use of heavy equipment in the wetted channel to construct cofferdams, is expected to result in insignificant adverse effects to listed fishes. Listed salmonids will be able to avoid interaction with instream machinery by temporarily relocating either upstream or downstream into suitable habitat adjacent to the worksite. In addition, the minimum distance between instream project sites and the maximum number of instream projects under the proposed Program would further reduce the potential aggregated effects of heavy equipment disturbance on listed salmonids

2.. Disturbance to Riparian Vegetation

Most proposed fisheries restoration actions are expected to avoid disturbing riparian vegetation through the proposed avoidance and minimization measures. In general, the restorative nature of these projects is to improve habitat conditions for salmonids, and thus, riparian vegetation disturbance is expected to be avoided, as practicable. However, there may be limited situations where avoidance is not possible.

In the event that streamside riparian vegetation is removed, the loss of riparian vegetation is expected to be small, due to minimization measures, and limited to mostly shrubs and an occasional tree. Most riparian vegetation impacts are expected to be typical riparian species such as willows and other shrubs, which are generally easier to recover or reestablish. In addition, the revegetation of disturbed riparian areas is expected to further minimize the loss of vegetation. Therefore, NMFS anticipates only an insignificant loss of riparian habitat and function within the action area to result from the proposed restoration activities.

3. Chemical Contamination from Equipment Fluids

Equipment refueling, fluid leakage, and maintenance activities within and near the stream channel pose some risk of contamination and potential take. In addition to toxic chemicals associated with construction equipment, water that comes into contact with wet cement during construction of a restoration project can also adversely affect water quality and may harm listed salmonids. However, all fisheries restoration projects will include the measures outlined in the sections entitled, *Measures to Minimize Disturbance From Instream Construction* and *Measures to Minimize Degradation of Water Quality* within Part IX of the Restoration Manual, which address and minimize pollution risk from equipment operation. Therefore, water quality degradation from toxic chemicals associated with the habitat restoration projects is discountable.

4. Reduced Benthic Macroinvertebrate Community

Benthic (*i.e.*, bottom dwelling) aquatic macroinvertebrates may be temporarily lost or their abundance reduced when stream habitat is dewatered (Cushman 1985). Effects to aquatic macroinvertebrates resulting from stream flow diversions and dewatering will be temporary because instream construction activities occur only during the low flow season, and rapid recolonization (about one to two months) of disturbed areas by macroinvertebrates are expected following rewatering (Cushman 1985, Thomas 1985, Harvey 1986). In addition, the effect of macroinvertebrate loss on juvenile coho salmon, Chinook salmon, or steelhead is likely to be negligible because food from upstream sources (via drift) would be available downstream of the dewatered areas since stream flows will be maintained around the project work site. Based on the foregoing, the loss of aquatic macroinvertebrates resulting from dewatering activities is not likely to adversely affect coho salmon, Chinook salmon, or steelhead.

B. Adverse Effects to Listed Species

In this section we identify the direct and indirect adverse effects of the proposed action on the listed species, their designated critical habitat, or both. The species and designated critical habitat that may be exposed and the anticipated responses will vary depending on the location of each individual habitat restoration project site. For example, some sites may occur in rivers and streams that have all three listed salmonids, while other sites may be located in streams where only one listed species is present.

Individual restoration projects authorized through the 10-year Program that require instream activities will be implemented during low flow periods between June 15 and November 1. The specific timing and duration of each individual restoration project will vary depending on the project type, specific project methods, and site conditions. However, the duration and magnitude of effects to listed salmonids and to salmonid critical habitat associated with implementation of individual restoration projects will be significantly minimized due to the multiple proposed avoidance and minimization measures.

Implementing individual restoration projects during the summer low-flow period will avoid emigrating coho salmon, Chinook salmon, and steelhead smolts and will minimize exposure to immigrating Chinook salmon and coho salmon adults at all habitat restoration project sites. The total number of projects and the location of individual projects authorized through the Program annually will vary from year to year depending on various factors, including funding and scheduling. If the rates of funding and project implementation remains consistent with the rates of the past several years, the total number of projects expected to be implemented each year should range between 15 and 30, however significant restoration efforts are predicted to occur in the Klamath Basin which could double the estimated number of projects (Bob Pagliuco, NOAA RC pers. comm. May 2011).

Except for riparian habitat restoration and streamflow augmentation, all proposed restoration types are expected to result in adverse effects to listed species. Despite the different scope, size, intensity, and location of these proposed restoration actions, the potential adverse effects to listed salmonids all result from dewatering, fish relocation, and increased sediment. Dewatering, fish relocation, and structural placement will result in direct effects to listed salmonids, where a small percentage of individuals are expected to be injured or killed. The effects from increased sediment mobilization into streams are usually indirect effects, where the effects to habitat, individuals, or both, are reasonably certain to occur and are later in time.

1. Dewatering

Although all project types include the possibility of dewatering, not all individual project sites will need to be dewatered. Based on personal communication with Bob Pagliuco of the NOAA RC (May 2011), an estimated 3 of 85 projects occurring between 2008 and 2011 (as of May 17, 2011) required dewatering. When dewatering is necessary, only a small reach of stream at each project site will be dewatered for instream construction activities. Dewatering encompasses placing temporary barriers, such as a cofferdam, to hydrologically isolate the work area, re-routing stream flow around the dewatered area, pumping water out of the isolated work area, relocating fish from the work area (discussed separately), and restoring the project site upon project completion. The length of contiguous stream reach that will be dewatered for most projects is expected to be less than 500 feet and no greater than 1000 feet for any one project site.

a. Exposure

Because the proposed dewatering would occur during the low flow period, the species and life stages most likely to be exposed to potential effects of dewatering are juvenile coho salmon and juvenile steelhead. Most juvenile Chinook salmon would be avoided since the timing of the instream activities occur after they have migrated to the ocean. A few juvenile Chinook salmon, especially with a stream-type life history strategy, as well as adult summer run steelhead and half-pounder steelhead, may also be exposed where these individuals are present at or near the proposed project sites, although past relocation results indicated the chances of encountering these species and life stages is very low (Flosi 2010). Dewatering is expected to occur mostly during the first half of the instream construction window (*e.g.*, to accommodate for the necessary construction time needed), and therefore should avoid exposure to adult Chinook salmon and adult coho salmon. Dewatering that occurs in the latter half of the instream construction window or in the range of summer run steelhead or half pounders, may expose adult Chinook salmon, early incoming coho salmon, summer steelhead, and half pounders to displacement (table 4). However, adult salmonids and half-pounders are not likely to be exposed because adults will avoid the construction area and dewatering is very rarely done so late in the low flow season.

b. Response

The effects of dewatering result from the placement of the temporary barriers, the trapping of individuals in the isolated area, and the diversion of streamflow. Fish relocation and ground disturbance effects are discussed further in sections 2 through 4 below. Rearing juvenile coho salmon, steelhead, and to a much lesser extent, juvenile stream-type Chinook salmon could be killed or injured if crushed during placement of the temporary barriers, such as cofferdams, though crushing is expected to be minimal due to evasiveness of most juveniles. Stream flow diversions could harm salmonids by concentrating or stranding them in residual wetted areas (Cushman 1985) before they are relocated, or causing them to move to adjacent areas of poor habitat (Clothier 1953, Clothier 1954, Kraft 1972, Campbell and Scott 1984). Salmonids, especially juveniles since they are not as visible as adults, that are not caught during the relocation efforts would be killed from either construction activities or desiccation.

Changes in flow are anticipated to occur within and downstream of project sites during dewatering activities. These fluctuations in flow, outside of dewatered areas, are anticipated to be small, gradual, and short-term, which should not result in any harm to salmonids. Stream flow in the vicinity of each project site should be the same as free-flowing conditions, except during dewatering and in the dewatered reach where stream flow is bypassed. Stream flow diversion and project work area dewatering are expected to cause temporary loss, alteration, and reduction of aquatic habitat.

Dewatering may result in the temporary loss of rearing habitat for juvenile salmonids. The extent of temporary loss of juvenile rearing habitat should be minimal because habitat at the restoration sites is typically degraded and the dewatered reaches are expected to be less than 500 feet per site and no more than a total of 1000 feet per project. These sites will be restored prior to project completion, and should be enhanced by the restoration project.

Effects associated with dewatering activities will be minimized due to the multiple minimization measures that will be utilized as described in the section entitled, *Measures to Minimize Impacts to Aquatic Habitat and Species During Dewatering of Projects* within Part IX of the Restoration Manual. Juvenile coho salmon, steelhead and stream-type Chinook salmon that avoid capture in the project work area will die during dewatering activities. NMFS expects that the number of coho salmon, Chinook salmon, or steelhead that will be killed as a result of barrier placement and stranding during site dewatering activities is very low, likely less than one percent of the total number of salmonids in the project area. The low number of juveniles expected to be injured or killed as a result of dewatering is based on the low percentage of projects that require dewatering (*i.e.*, generally only up to 4 percent), the avoidance behavior of juveniles to disturbance, the small area affected during dewatering at each site, the low number of juveniles in the typically degraded habitat conditions common to proposed restoration sites, and the low numbers of juvenile salmonids expected to be present within each project site after relocation activities. Table 4 summarizes the dewatering effects to salmonids.

Table 4. Summary of effects to individual listed species from dewatering.

Action	Life Stage	Species	Anticipated Exposure	Response
Temporary barrier placement	Juvenile	NC Steelhead SONCC Coho CC Chinook Salmon	Low Low Rare	Injury or death from being crushed
Dewatering	Juvenile	NC Steelhead SONCC Coho CC Chinook Salmon	Low Low Rare	Desiccation (Death)

2. <u>Fish Relocation Activities</u>

All project sites that require dewatering will include fish relocation. CDFG personnel (or designated agents) capture and relocate fish (and amphibians) away from the restoration project work site to minimize adverse effects of dewatering to listed salmonids. Fish in the immediate project area will be captured by seine, dip net and/or by electrofishing, and will then be transported and released to a suitable instream location.

a. Exposure

Because fish relocation is required when dewatering, the species and life stages most likely to be exposed to fish relocation are juvenile coho salmon and steelhead. Most juvenile Chinook salmon will not be exposed since the timing of instream activities occur after they have emigrated from streams. However, a few juvenile Chinook salmon, especially those with a stream-type life history strategy, may also be exposed where these individuals are stranded within the dewatering area (table 4).

b. Response

Fish relocation activities may injure or kill rearing juvenile coho salmon and steelhead because these individuals are most likely to be present in the project sites. Any fish collecting gear, whether passive or active (Hayes 1983) has some associated risk to fish, including stress, disease transmission, injury, or death. The amount of injury and mortality attributable to fish capture varies widely depending on the method used, the ambient conditions, and the expertise and experience of the field crew. The effects of seining and dip-netting on juvenile salmonids include stress, scale loss, physical damage, suffocation, and desiccation. Electrofishing can kill juvenile salmonids, and researchers have found serious sublethal effects including spinal injuries (Reynolds 1983, Habera et al. 1996, Habera et al. 1999, Nielsen 1998, Nordwall 1999). The long-term effects of electrofishing on salmonids are not well understood. Although chronic effects may occur, most effects from electrofishing occur at the time of capture and handling.

Most of the stress and death from handling result from differences in water temperature between the stream and the temporary holding containers, dissolved oxygen levels, the amount of time that fish are held out of the water, and physical injury. Handling-related stress increases rapidly if water temperature exceeds 18 °C or dissolved oxygen is below saturation. A qualified fisheries biologist will relocate fish, following both CDFG and NMFS electrofishing guidelines. Because of these measures, direct effects to, and mortality of, juvenile coho salmon and steelhead during capture will be greatly minimized.

Although sites selected for relocating fish will likely have similar water temperature as the capture site and should have ample habitat, in some instances relocated fish may endure short-term stress from crowding at the relocation sites. Relocated fish may also have to compete with other salmonids, which can increase competition for available resources such as food and habitat. Some of the fish at the relocation sites may choose not to remain in these areas and may move either upstream or downstream to areas that have more habitat and lower fish densities. As each fish moves, competition remains either localized to a small area or quickly diminishes as fish disperse.

Fish relocation activities are expected to minimize individual project impacts to juvenile coho salmon and steelhead by removing them from restoration project sites where they would have experienced high rates of injury and mortality. Fish relocation activities are anticipated to only affect a small number of rearing juvenile coho salmon and/or steelhead within a small stream reach at and near the restoration project site and relocation release site(s). Rearing juvenile coho salmon and/or steelhead present in the immediate project work area will be subject to disturbance, capture, relocation, and related short-term effects. Most of the take associated with fish relocation is anticipated to be non-lethal, however, a very low number of rearing juvenile (mostly YOY) coho salmon and/or steelhead captured may become injured or die. In addition, the number of fish affected by increased competition is not expected to be significant at most fish relocation sites, based upon the suspected low number of relocated fish inhabiting the small project areas.

Effects associated with fish relocation activities will be significantly minimized due to the multiple minimization measures that will be utilized, as described in the section entitled, *Measures to Minimize Injury and Mortality of Fish and Amphibian Species During Dewatering* within Part IX of the Restoration Manual. NMFS expects that fish relocation activities associated with implementation of individual restoration projects will not significantly reduce the number of returning listed salmonid adults. Fish relocation activities will occur during the summer low-flow period after emigrating smolts have left the restoration project sites and before adult fish travel upstream. Therefore, the majority of listed salmonids that will be captured during relocation activities will be age-0 coho and juvenile steelhead parr of various ages. Although most mortalities of coho salmon and/or steelhead during fish relocation activities will occur almost exclusively at the YOY stage, there is a potential of unintentional mortality of a one- or two-year old fish.

Based on the CDFG FRGP annual monitoring reports (Collins 2004, 2005; CDFG 2006, 2007, 2008, 2009, 2010), NMFS is able to estimate the maximum number of federally listed salmonids expected to be captured, injured, and killed each year from the dewatering and relocation activities (table 5). When comparing the past 4 years of NOAA RC-funded projects, only about three were dewatered and required relocation of listed species (Pagliuco, pers. comm. 2011). The CDFG monitoring reports show that the FRGP program dewaters approximately 12 percent of their funded projects (Table 5). When estimating the maximum number of listed salmonids that are expected to be captured each year, NMFS used the CDFG FRGP monitoring reports, reducing the highest number of captured individuals by a factor of 4 to account for the lower number of projects expected to be dewatered under the proposed program (Table 6). NMFS used the highest percentage recorded under the FRGP program to estimate the percent of each species that would be injured or killed each year (Table 6). As a result, NMFS expects that (1) no more than 766 juvenile SONCC coho salmon will be captured, 0.6 percent of the captured coho salmon will be injured, and 0.6 percent of the captured coho salmon will be killed annually; (2) no more than 1,502 juvenile NC steelhead will be captured, 0.7 percent of the captured steelhead will be injured, and 0.6 percent of the captured steelhead will be killed annually; and (3) no more than 5 juvenile CC Chinook salmon will be captured, and one of those captured will be injured or killed (Table 6).

Table 5. Dewatering and relocation information for CDFG FRGP Program.

Species	Year	# Projects in Humboldt County	# Projects Dewatered	# Captured	# Injured	% Injured	# Killed	% Killed
Coho	2002	21	3	0	-	-	-	-
Coho	2003	42	8	8	-	-	0	0.00
Coho	2004	123	10	0	-	-	-	-
Coho	2005	158	17	344	2	0.58	2	0.58
Coho	2006	137	18	185	1	0.54	0	0.00
Coho	2007	147	14	253	0	0.00	11	4.35
Coho	2008	119	15	3064	0	0.00	0	0.00
Coho	2009	110	6	18	0	0.00	0	0.00
Coho	2010	87	8	3	0	0.00	0	0.00
Highest number and percent for coho salmon				**3064**		**0.58**		**0.58***
*The highest data point (4.35%) was excluded as an outlier								
Steelhead	2002	21	3	1539	-	-	5	0.32
Steelhead	2003	42	8	2361	-	-	7	0.30
Steelhead	2004	123	10	2306	2	0.09	2	0.09
Steelhead	2005	158	17	618	2	0.32	2	0.32
Steelhead	2006	137	18	2255	16	0.71	6	0.27
Steelhead	2007	147	14	3732	10	0.27	21	0.56
Steelhead	2008	119	15	6007	12	0.20	32	0.53
Steelhead	2009	110	6	2186	7	0.32	7	0.32
Steelhead	2010	87	8	633	3	0.47	3	0.47
Highest number and percent for steelhead				**6007**		**0.71**		**0.56**
Chinook	2008	119	15	18	0	0.00	0	0.00

Highest number and percent for Chinook salmon	**18**		**0**		**0**

Table 6. Estimated maximum number of salmonids that will be captured, injured, or killed under the proposed program.

Species	Max. # Individuals Captured/Yr*	Max. % Injured/Yr	Max. # Individuals Injured/Yr	Max. % Killed/Yr	Max. # Individuals Killed/Yr
Coho	766	0.6	5	0.6**	5
Steelhead	1502	0.7	11	0.6	9
Chinook	5	-	1***	-	1***

*Maximum number of individuals captured per year calculated from highest data point in table 5 and divided by four to account for lower rate of dewatered projects
**The highest data point (4.35%) in table 5 was excluded as an outlier
***Because the previous data (table 5) resulted in 0% injured or killed, NMFS will conservatively expect one or less individual injured or killed per year.

3. Structural Placement

Most of the proposed restoration project types include the potential for placement of structures in the stream channel. These structural placements can vary in their size and extent, depending on their restoration objective. Most structural placements are discrete where only a localized area will be affected. The salmonids exposed to such structural placements are the same juvenile species that would be exposed to dewatering effects. Where structural placements are small and discrete, salmonids are expected to avoid the active construction area and thus will not be crushed. When structural placements are large or cover a large area, such as gravel augmentation, some juvenile salmonids may be injured or killed. However, the number of juveniles injured or killed is expected to be no more than the number of individuals that will be killed by desiccation after the reach is dewatered without such structural placement. Fish relocation is expected to remove most salmonids. In essence, juvenile fish that are not relocated will be killed by either dewatering or structural placement.

4. Increased Mobilization of Sediment within the Stream Channel

The proposed restoration project types involve various degrees of earth disturbance. Inherent with earth disturbance is the potential to increase background suspended sediment loads for a short period during and following project completion.

All project types involving ground disturbance in or adjacent to streams are expected to increase turbidity and suspended sediment levels within the project work site and downstream areas. Therefore, instream habitat improvement, instream barrier modification for fish passage improvement, stream bank stabilization, fish passage improvements at stream crossings, small dam removal[4], creation of off channel/side channel habitat, and upslope watershed restoration,[5]

4 Because of the sideboards and engineering requirements described in the proposed action, small dam removal is

and fish screen construction may result in increased mobilization of sediment into streams. Although riparian restoration may involve ground disturbance adjacent to streams, the magnitude and intensity of this ground disturbance is expected to be small and isolated to the riparian area. Fish screen projects are not expected to release appreciable sediment into the aquatic environment.

a. Exposure

In general, sediment-related effects are expected during the summer construction season (June 15 to November 1), as well as during peak-flow winter storm events when remaining loose sediment is mobilized. During summer construction, the species and life stages most likely to be exposed to potential effects of increased sediment mobilization are juvenile coho salmon and juvenile steelhead. As loose sediment is mobilized by higher winter flows, adult Chinook salmon, coho salmon, and steelhead may also be exposed to increased turbidity. Removal of small dams and road crossing projects will have the greatest potential for releasing excess sediment. However, minimization measures, such as removing excess sediment from the dewatered channel prior to returning flow will limit the amount of sediment released. The increased mobilization of sediment is not likely to degrade spawning gravel because project related sediment mobilization should be minimal due to the use of sideboards and minimization measures. This small amount of sediment is expected to affect only a short distance downstream, and should be easily displaced by either higher fall/winter flows or redd building. In the winter, the high flows will carry excess fine sediment downstream to point bars and areas with slower water velocities. Because redds are built where water velocities are higher, the minimally increased sediment mobilization is not expected to smother existing redds. Therefore, salmonid eggs and alevin are not expected to be exposed to the negligible increase in sediment on redds. Since most restoration activities will focus on improving areas of poor instream habitat, NMFS expects the

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expected to have similar sediment mobilization effects as culvert replacement or removal

[5] Although road restoration projects may entail culvert replacement or removal, the resulting sediment effect is expected to be significantly smaller when compared to a typical fish passage improvement project. Road restoration projects typically deal with upslope road networks located high within the watershed drainage network. As a result, typical road crossings in these upslope areas largely occur in higher gradient, first or second order stream channels and feature small (*e.g.,* less than 4-foot diameter) culverts. In contrast, fish passage projects funded through the Program typically focus limited restoration funding on high-priority fish passage issues located on third or fourth order stream networks that, when completed, will re-establish fish access to large expanses of upstream habitat. In effect, both the size and gradient of upslope channels and culverts largely limit downstream sediment impacts during road decommissioning projects. Small, high gradient stream channels typically transport sediment downstream more efficiently (and therefore store less upstream of the culvert) than lower gradient, higher order stream reaches where flow and channel morphology favor sediment deposition. Furthermore, the comparative size of these upslope road culverts (16-48 inch diameter) likely limit the volume of any sediment wedge that can develop upstream of the structure. Because of these unique characteristics common to culverts typically found on upslope roads, NMFS anticipates individual culvert projects that are part of a larger road decommissioning project will not approach an effect level similar to larger fish passage projects, and thus are not considered when computing maximum project density per watershed (as detailed in the section titled "Sideboards, Minimization Measures, and other Requirements" within the Proposed Action).

number of fish inhabiting individual project areas during these periods of increased sediment input, and thus directly affected by construction activities, to be relatively small.

b. Response

Restoration activities may cause temporary increases in turbidity and deposition of excess sediment may alter channel dynamics and stability (Habersack and Nachtnebel 1995, Hilderbrand et al. 1997, Powell 1997, Hilderbrand et al. 1998). Erosion and runoff during precipitation and snowmelt will increase the supply of sediment to streams. Heavy equipment operation in upland and riparian areas increases soil compaction, which can increase runoff during precipitation. High runoff can then, in turn, increase the frequency and duration of high stream flows in construction areas. Higher stream flows increase stream energy that can scour stream bottoms and transport greater sediment loads farther downstream than would otherwise occur.

Sediment may affect fish by a variety of mechanisms. High concentrations of suspended sediment can disrupt normal feeding behavior (Berg and Northcote 1985), reduce growth rates (Crouse et al. 1981), and increase plasma cortisol levels (Servizi and Martens 1992). Increased sediment deposition can fill pools and reduce the amount of cover available to fish, decreasing the survival of juveniles (Alexander and Hansen 1986) and holding habitat for adults. Excessive fine sediment can interfere with development and emergence of salmonids (Chapman 1988). Upland erosion and sediment delivery can increase substrate embeddedness. These factors make it harder for fish to excavate redds, and decreases redd aeration (Cederholm et al. 1997). High levels of fine sediment in streambeds can also reduce the abundance of food for juvenile salmonids (Cordone and Kelly 1961, Bjornn et al. 1977).

Short-term increases in turbidity are anticipated to occur during dewatering activities and/or during construction of a coffer dam. Research with salmonids has shown that high turbidity concentrations can: reduce feeding efficiency, decrease food availability, reduce dissolved oxygen in the water column, result in reduced respiratory functions, reduce tolerance to diseases, and can also cause fish mortality (Berg and Northcote 1985, Gregory and Northcote 1993, Velagic 1995, Waters 1995). Mortality of very young coho salmon and steelhead fry can result from increased turbidity (Sigler et al. 1984). Even small pulses of turbid water will cause salmonids to disperse from established territories (Waters 1995), which can displace fish into less suitable habitat and/or increase competition and predation, decreasing chances of survival. Nevertheless, much of the research mentioned above focused on turbidity levels significantly higher than those likely to result from the proposed restoration activities, especially with implementation of the proposed avoidance and minimization measures.

Yet, research investigating the effects of sediment concentration on fish density has routinely focused on high sediment levels. For example, Alexander and Hansen (1986) measured a 50 percent reduction in brook trout (*Salvelinus fontinalis*) density in a Michigan stream after manually increasing the sand sediment load by a factor of four. In a similar study, Bjornn et al.

(1977) observed that salmonid density in an Idaho stream declined faster than available pool volume after the addition of 34.5 m^3 of fine sediment into a 165 m study section. Both studies attributed reduced fish densities to a loss of rearing habitat caused by increased sediment deposition. However, streams subject to infrequent episodes adding small volumes of sediment to the channel may not experience dramatic morphological changes (Rogers 2000). Similarly, research investigating severe physiological stress or death resulting from suspended sediment exposure has also focused on concentrations much higher than those typically found in streams subjected to minor/moderate sediment input (reviewed by Newcombe and MacDonald (1991) and Bozek and Young (1994)).

In contrast, the lower concentrations of sediment and turbidity expected from the proposed restoration activities are unlikely to be severe enough to cause injury or death of listed juvenile coho salmon and/or steelhead. Instead, the anticipated low levels of turbidity and suspended sediment resulting from instream restoration projects will likely result in only temporary behavioral effects. Recent monitoring of newly replaced culverts[6] within the action area detailed a range in turbidity changes downstream of newly replaced culverts following winter storm events (Humboldt County 2002, 2003 and 2004). During the first winter following construction, turbidity rates (NTU) downstream of newly replaced culverts increased an average of 19 percent when compared to measurements directly above the culvert. However, the range of increases within the 11 monitored culverts was large (n=11; range 123% to -21%). Monitoring results from one- and two-year-old culverts were much less variable (n=11; range:12% to -9%), with an average increase in downstream turbidity of one percent. Although the culvert monitoring results show decreasing sediment effects as projects age from year one to year three, a more important consideration is that most measurements fell within levels that were likely to only cause slight behavioral changes [*e.g.*, increased gill flaring (Berg and Northcote 1985), elevated cough frequency (Servizi and Marten 1992), and avoidance behavior (Sigler et al. 1984)]. Turbidity levels necessary to impair feeding are likely in the 100 to 150 NTU range (Gregory and Northcote 2003, Harvey and White 2008). However, only one of the Humboldt County measurements exceeded 100 NTU (NF Anker Creek, year one), whereas the majority (81 percent) of downstream readings were less than 20 NTU. Importantly, proposed minimization measures, some of which were not included in the culvert work analyzed above, will likely ensure that future sediment effects from fish passage projects will be less than those discussed above. Therefore, the small pulses of moderately turbid water expected from the proposed instream restoration projects will likely cause only minor physiological and behavioral effects, such as dispersing salmonids from established territories, potentially increasing interspecific and intraspecific competition, as well as predation risk for the small number of affected fish.

Upslope watershed restoration activities, such as road decommissioning and upgrading, are

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6 When compared to other instream restoration projects (*e.g.*, bank stabilization, instream structure placement), culvert replacement/upgrade projects typically entail a higher degree of instream construction and excavation, and by extension greater sediment effects. Thus, we have chosen to focus on culvert projects as a “worst case” scenario when analyzing potential sediment effects from instream projects.

expected to mobilize sediment through ripping and recontouring. However, these activities are generally higher up in the watersheds where the adjacent streams are typically first or second order, and are typically not fish bearing. Sediment mobilization will be minimized through road outsloping, reseeding and mulching disturbed areas, and other erosion control measures. These erosion control measures should prevent a majority of the sediment from reaching fish bearing streams. In addition, road projects funded by the NOAA RC indicate that the subject roads already pose sediment problems for salmonids, and are in need of upgrading, repair, or decommissioning. Therefore, upslope road work (*e.g.,* road decommissioning), when implemented with the proposed erosion control measures, may result in about the same volume of sediment introduced into streams prior to road work in the short term.

Upslope restoration activities, in the long term, should result in reduced sediment volume than unimproved roads. Road upgrading and decommissioning activities have been documented to reduce road-related erosion (Madej 2001, Switalski et al. 2004, McCaffery et al. 2007) and landslide risk (Switalski et al. 2004). Road decommissioning studies in the Redwood Creek watershed, Humboldt County, have found that treated roads, on average, contributed only 25% of the sediment volume produced from untreated roads (Madej 2001). Vegetation, in particular, when reestablished on decommissioned roads, leads to reduced fine sediment in adjacent streams (McCaffery et al. 2007). The amount of fine sediment mobilized from highly revegetated decommissioned roads can be at levels that existed prior to the road construction (McCaffery et al. 2007).

NMFS does not expect sediment effects to accumulate at downstream restoration sites within a given watershed. Sediment effects generated by each individual project will likely impact only the immediate footprint of the project site and up to approximately 1500 feet of channel downstream of the site. Studies of sediment effects from culvert construction determined that the level of sediment accumulation within the streambed returned to control levels between 358 to 1,442 meters downstream of the culvert (LaChance et al. 2008). Because of the multiple measures to minimize sediment mobilization, described in the Restoration Manual under *Measures to Minimize Degradation of Water Quality,* on pages IX-50 and IX-51, downstream sediment effects from the proposed restoration projects are expected to extend downstream for a distance consistent with the range presented by LaChance et al. (2008). The proposed 800-foot buffer between instream projects is likely large enough to preclude sediment effects from accumulating at downstream project sites. Furthermore, the temporal and spatial scale at which project activities are expected to occur will also likely preclude significant additive sediment related effects. Assuming projects will continue to be funded and implemented similar to the past several years, NMFS expects that individual restoration projects sites will occur over a broad spatial scale each year. In other words, restoration projects occurring in close proximity to other projects during a given restoration season is unlikely, thus diminishing the chance that project effects would combine. Finally, effects to instream habitat and fish are expected to be short-term, since most project-related sediment will likely mobilize during the initial high-flow event the following winter season. Subsequent sediment mobilization may occur following the next two winter seasons, but generally should subside to baseline conditions by the third year as found in other studies, such as Klein et al. (2006), and suggested by the Humboldt County data (Humboldt County 2004).

C. Effects to Critical Habitat

1. Adverse Effects to PCEs

The critical habitat designation for salmonid species includes several Primary Constituent Elements (PCEs) which will be affected under the proposed action. These PCEs include spawning, rearing, and migration habitats.

Juvenile rearing sites require cover and cool water temperatures during the summer low flow period. Over-wintering juvenile salmonids require refugia to escape to during high flows in the winter. Adverse effects to rearing habitat will primarily occur as a result of dewatering the channel and increasing sediment input during instream activities. Loss of rearing sites can occur through dewatering habitat and the filling of pools with fine sediment. However, these adverse effects are expected to be temporary and of short duration. The activities described in the proposed action will increase quality of rearing habitat over the long term. Rearing habitat will be improved by adding complexity that will increase pool formation, cover structures, and velocity refugia.

As explained above, spawning habitat is not likely to be adversely affected by the temporary increase in fine sediment resulting from proposed activities. Spawning habitat is located where water velocities are higher, where mobilized fine sediment is less likely to settle. Where limited settling does occur in spawning habitat, the minimally increased sediment is not expected to degrade spawning habitat due to the small amounts and short term nature of the effects. Activities described in the proposed action will improve the quality of spawning habitat over the long term. Spawning habitat will be improved by reducing the amount of sediment that enters the stream in the long term through various types of erosion control. Additionally, gravel augmentation, described in the proposed action will increase the amount of spawning habitat available.

Migratory habitat is essential for juvenile salmonids outmigrating to the ocean as well as adults returning to their natal spawning grounds. Migratory habitat may be affected during the temporary re-routing of the channel during project implementation, however a migratory corridor will be maintained at all times. The proposed action will have long term beneficial effects to migratory habitat. Activities adding complexity to habitat will increase the number of pools, providing resting areas for adults, and the removal of barriers will increase access to habitat.

Misguided restoration efforts often fail to produce the intended benefits and can even result in further habitat degradation. Improperly constructed projects can cause greater adverse effects than the pre-existing condition. The Restoration Manual provides design guidance and construction techniques that facilitate proper design and construction of restoration projects. Properly constructed stream restoration projects will increase available habitat, habitat complexity, stabilize channels and streambanks, increase spawning gravels, decrease sedimentation, and increase shade and cover for salmonids. Since 2004, the percentage of fisheries restoration projects implemented under CDFG's FRGP rated as either good or excellent ranged between 71 to 96 percent, with an average of 87 percent (Collins 2005, CDFG 2006, 2007, 2008, 2009, 2010). NMFS assumes similar success rates will result from the proposed Program due to consistencies in the proposed action. Therefore, most of the proposed restoration actions should continue to be effectively implemented, and thus enhance existing habitat conditions at the project sites.

The sideboards proposed not only limit the duration of effects, also limit the magnitude of the effects. Sediment effects are expected to remain minimal and not accumulate by implementing sideboards that limit the number of, and distance between sediment producing activities.

2. <u>Beneficial Effects to the PCEs</u>

Habitat restoration projects that are funded by the NOAA RC and authorized by the Corps will be designed and implemented consistent with the techniques and minimization measures presented in the Restoration Manual to maximize the benefits of each project while minimizing effects to salmonids. Most restoration projects are for the purpose of restoring degraded salmonid habitat and are intended to improve instream cover, pool habitat, spawning gravels, and flow levels; remove barriers to fish passage; and reduce or eliminate erosion and sedimentation sources. Others prevent fish injury or death, such as screening water diversions. Although some habitat restoration projects may cause small losses to the juvenile life history stage of listed salmonids in the project areas during construction, all of these projects are anticipated to improve salmonid habitat and salmonid survival over the long-term.

a. Instream Habitat Improvements

Instream habitat structures and improvement projects will provide escape from predators and resting cover, increase spawning habitat, improve upstream and downstream migration corridors, improve pool to riffle ratios, and add habitat complexity and diversity. Some structures will be designed to reduce sedimentation, protect unstable banks, stabilize existing slides, provide shade, and create scour pools.

Placement of LWD into streams can result in the creation of pools that influence the distribution and abundance of juvenile salmonids (Spalding et al. 1995, Beechie and Sibley 1997). LWD influences the channel form, retention of organic matter and biological community composition. In small (<10 m bankfull width) and intermediate (10 to 20 m bankfull width) streams, LWD contributes channel stabilization, energy dissipation and sediment storage (Cederholm et al.

1997). Presence and abundance of LWD is correlated with growth, abundance and survival of juvenile salmonids (Fausch and Northcote 1992, Spalding et al. 1995). The size of LWD is important for habitat creation (Fausch and Northcote 1992).

For placement of root wads, digger logs, upsurge weirs, boulder weirs, vortex boulder weirs, boulder clusters, and boulder wing-deflectors (single and opposing), long-term beneficial effects are expected to result from the creation of scour pools that will provide rearing habitat for juvenile coho salmon and steelhead. Improper use of weir and wing-deflector structures can cause accelerated erosion on the opposing bank, however, this can be avoided with proper design and implementation. Proper placement of single and opposing log wing-deflectors and divide logs, will provide long-term beneficial effects from the creation or enhancement of pools for summer rearing habitat and cover for adult salmonids during spawning. Proper placement of digger logs will likely create scour pools that will provide complex rearing habitat, with overhead cover, for juvenile salmonids and low velocity resting areas for migrating adult salmonids. Spawning gravel augmentation will provide long-term beneficial effects by increasing spawning gravel availability while reducing inter-gravel fine sediment concentrations.

Also, for projects where stream bank erosion is a concern, the various weir structures and wing-deflector structures likely to be authorized under the proposed program direct flow away from unstable banks and provide armor (a hard point) to protect the toe of the slope from further erosion. Successfully reducing streambank erosion will offset the increased sediment mobilization into streams from other restoration actions authorized under the proposed program. Boulder faces in the deflector structures have the added benefit of providing invertebrate habitat, and space between boulders provides juvenile salmonid escape cover.

The various weir structures can also be used to replace the need to annually build gravel push up dams. Once these weir structures are installed and working properly, construction equipment entering and modify the channel would no longer be needed prior to the irrigation season. The benefits of reducing or eliminating equipment operation during the early spring reduces the possibility of crushing salmon and steelhead redds and young salmonids.

b. Instream Barrier Modification for Fish Passage Improvement

Instream barrier modification for fish passage improvement projects will improve salmonid fish passage and increase access to suitable salmonid habitat. Long-term beneficial effects are expected to result from these projects by improving passage at sites that are partial barriers, or by providing passage at sites that are total barriers. Both instances will provide better fish passage and will increase access to available habitat.

c. Stream Bank Stabilization

Stream bank stabilization projects will reduce sedimentation from bank erosion, decrease turbidity levels, and improve water quality for salmonids over the long-term. Reducing sediment delivery to the stream environment will improve fish habitat and fish survival by increasing fish embryo and alevin survival in spawning gravels, reducing injury to juvenile salmonids from high concentrations of suspended sediment, and minimizing the loss of quality and quantity of pools from excessive sediment deposition. Successful implementation of stream bank stabilization projects will offset the increased sediment delivery into streams from other restoration actions authorized under the proposed Program. In addition, the various proposed streambank restoration activities are likely to enhance native riparian forests or communities, provide increased cover (large wood, boulders, vegetation, and bank protection structures) and a long-term source of all sizes of instream wood.

d. Fish Passage Improvement at Stream Crossings

Thousands of dilapidated stream crossings exist on roadways throughout the coastal drainages of northern and central California, many preventing listed salmonids from accessing vast expanses of historic spawning and rearing habitat located upstream of the structure. In recent years, much attention has been focused on analyzing fish passage at stream crossings through understanding the relationship between culvert hydraulics and fish behavior (Six Rivers National Forest Watershed Interaction Team 1999).
Reestablishing the linkages between mainstem migratory habitat and headwater spawning/rearing habitat will help to facilitate the recovery of salmonids throughout the action area. Reestablishing passage for listed salmonids into previously unavailable upstream habitat will also likely increase reproductive success and ultimately fish population size in watersheds where the amount of quality freshwater habitat is a limiting factor.

e. Upslope Watershed Restoration

Upslope watershed restoration projects will stabilize potential upslope sediment sources, which will reduce excessive delivery of sediment to anadromous salmonid streams. Some of these projects will reduce the potential for catastrophic erosion and delivery of large amounts of sediment to stream channels. Road improvement projects will reduce sediment delivery to streams in the long-term. Road decommissioning projects should be even more beneficial than road improvement projects in that all or nearly all of the hydrologic and sediment regime effects of the roads would be removed. Long-term beneficial effects resulting from these activities include restored hydrologic function including transport of sediment and LWD, reduced risk of washouts and landslides, and reduced sediment delivery to streams. In the long-term, these projects will tend to rehabilitate substrate habitat by reducing the risk of sediment delivery to streams and restore fish passage by correcting fish barriers caused by roads. Road decommissioning projects will also tend to rehabilitate impaired watershed hydrology by reducing increases in peak flows caused by roads and reducing increases in the drainage network caused by roads.

f. Fish Screens

Water diversions can greatly affect aquatic life when organisms are sucked into intake canals or pipes -- an estimated 10 million juvenile salmonids were lost annually through unscreened diversions in the Sacramento River alone (Upper Sacramento River Fisheries and Riparian Habitat Advisory Council 1989). Once entrained, juvenile fish can be transported to less favorable habitat (*e.g.*, a reservoir, lake or drainage ditch) or killed instantly by turbines. Fish screens are commonly used to prevent entrainment of juvenile fish in water diverted for agriculture, power generation, or domestic use.

Fish screens substantially decrease juvenile fish loss in stream reaches where surface flow is regularly diverted out of channel. Surface diversions vary widely in size and purpose, from small gravity fed diversion canals supplying agricultural water to large hydraulic pumping systems common to municipal water or power production. All screening projects have similar goals, most notably preventing fish entrainment into intake canals and impingement against the mesh screen. To accomplish this, all screening projects covered by this opinion will strictly follow guidelines drafted by CDFG and NMFS, which outline screen design, construction and placement, as well as designing and implementing successful juvenile bypass systems that return screened fish back to the stream channel.

Fish screen projects will reduce the risk for fish being entrained or sucked into irrigation systems. Well-designed fish screens and associated diversions ensure that fish injury or stranding is avoided, and fish are able to migrate through stream systems at the normal time of year.

VII. CUMULATIVE EFFECTS

NMFS must consider both the "effects of the action" and the cumulative effects of other activities in determining whether the action is likely to jeopardize the continued existence of the salmonid ESUs and DPSs considered in this opinion or result in the destruction or adverse modification their designated critical habitat. Under the ESA, cumulative effects include the effects of future State, tribal, local, or private actions that are reasonably certain to occur in the action area. Listed salmonid species may be affected by numerous future non-federal activities, including timber harvest, road construction, residential development, and agriculture, etc., which are described in the *Environmental Baseline* section.

Non-Federal activities that are reasonably certain to occur within the action area include agricultural practices, water withdrawals/diversions, mining, state or privately sponsored habitat restoration activities on non-Federal lands, road work, timber harvest, and residential growth.

A search of upcoming timber harvest plans on the CalFire website confirms that timber harvesting is expected to continue in the next five years (http://www.fire.ca.gov/ResourceManagement/THPStatusUpload/THPStatusTable.html). NMFS assumes these activities, and similar resultant effects (as described in the *Status of the Species* and *Environmental Baseline* sections), on listed salmonids species will continue through the ten year period of this opinion.

VIII. EFFECTS OF INTERRELATED AND INTERDEPENDENT ACTIONS

No interrelated and interdependent effects are expected to occur as a result of the proposed Program.

IX. INTEGRATION AND SYNTHESIS

SONCC coho salmon populations throughout the action area have shown a dramatic decrease in both numbers and distribution and do not occupy many of the streams where they were found historically. Both the presence-absence and trend data available for SONCC coho salmon suggest that many populations in the larger basins (*e.g.*, Eel and Klamath) continue to decline. The poor condition of their habitat in many areas and the compromised genetic integrity of some stocks pose a serious risk to the survival and recovery of SONCC coho salmon. Based on the above information, recent status reviews have concluded that SONCC coho salmon are "likely to become endangered in the foreseeable future."

Steelhead populations throughout northern California have also shown a decrease in abundance, but are still widely distributed throughout most of the DPS. Although NC steelhead have experienced significant declines in abundance, and long-term population trends suggest a negative growth rate, they have maintained a better distribution overall when compared to the SONCC coho salmon ESU. This suggests that, while there are significant threats to the population, they possess a resilience (based in part, on a more flexible life history) that likely slows their decline. However, the poor condition of their habitat in many areas and the compromised genetic integrity of some stocks pose a risk to the survival and recovery of NC steelhead. Based on the above information, recent status reviews and available information indicate NC steelhead are likely to become endangered in the foreseeable future.

The most recent CC Chinook salmon status review found continued evidence of low population sizes relative to historical abundance. Although mixed abundance trends within some larger watersheds in the north may suggest some populations are persisting, the low abundance, low productivity, and potential extirpations of populations in the southern part of the CC Chinook salmon ESU are of concern. The 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. Thus, NMFS concludes the CC Chinook salmon ESU falls far short of historic population numbers and distribution, and is therefore not viable in regards to the population size VSP parameter. The ESU's geographic distribution has been moderately reduced, but especially for southern populations in general, and spring-run Chinook populations in particular. Based on the above information, recent status reviews and available information indicate CC Chinook are likely to become endangered in the foreseeable future.

Currently accessible salmonid habitat throughout the action area has been severely degraded, and the condition of designated critical habitats, specifically their ability to provide for long-term salmonid conservation, has also been degraded from conditions known to support viable salmonid populations. Intensive land and stream manipulation during the past century (*e.g.*, logging, agricultural/livestock development, mining, urbanization, and river dams/diversion) has modified and eliminated much of the historic salmonid habitat in central and northern California. Impacts of concern include alteration of stream bank and channel morphology, alteration of water temperatures, loss of spawning and rearing habitat, fragmentation of habitat, loss of downstream recruitment of spawning gravels and LWD, degradation of water quality, removal of riparian vegetation resulting in increased stream bank erosion, increases in erosion entry to streams from upland areas, loss of shade (higher water temperatures), and loss of nutrient inputs (61 FR 56138).

Although projects authorized under the Program are for the purpose of restoring anadromous salmonid habitat, small amounts of take of listed salmonids will likely result from fish relocation activities and the temporary effects of sediment mobilization, modified hydrology, and other minor effects. NMFS anticipates only small numbers of juvenile salmon and/or steelhead may be adversely affected at each individual restoration project work site. Adverse effects to listed salmonids at these sites are primarily expected to be in the form of short-term behavioral effects with minimal mortality. Salmonids present during project construction may be disturbed, displaced, injured or killed by project activities, and salmonids present in the project work area will be subject to capture, relocation, and related stresses. Most unintentional mortalities of salmon and/or steelhead during fish relocation activities and dewatering will occur exclusively at the juvenile stage. Short-term impacts to salmonid habitat from restoration activities will be minimal and localized at each project site. The duration and magnitude of direct effects to listed salmonids and to designated critical habitat associated with implementation of individual restoration projects will be significantly minimized due to the multiple minimization measures that will be utilized during implementation. NMFS anticipates the effects of individual restoration projects will not reduce the number of returning listed salmonid adults. The temporal and spatial limits (*i.e.*, sideboards) included in the proposed action will minimize significant additive effects.

NMFS has determined these effects are not likely to appreciably reduce the numbers, distribution or reproduction of salmon and/or steelhead within each watershed where restoration projects occur. This is based on the Program's numeric limit per year and per watershed, the low percentage of projects that result in direct effects to salmonids and the minor short-term effects resulting from increased turbidity levels. All of the restoration projects are intended to restore degraded salmonid habitat and improve instream cover, pool habitat, and spawning gravel; screen diversions; remove barriers to fish passage; and reduce or eliminate erosion and sedimentation impacts. Although there will be short-term impacts to salmonid habitat associated with a small percentage of projects implemented annually, NMFS anticipates most projects implemented annually will provide long-term improvements to salmonid habitat. NMFS also anticipates that the additive beneficial effects to salmonid habitat over the ten-year period of the proposed action should improve local instream salmonid habitat conditions for multiple life stages of salmonids and should improve survival of local populations of salmonids into the future. Restored habitat resulting from restoration projects should improve adult spawning success, juvenile survival, and smolt outmigration, which will in turn lead to improved abundance, productivity, spatial structure, and diversity within the watershed population. As individual population viability improves, so will the viability of the ESU's and DPS improve as well.

X. CONCLUSION

After reviewing the best available scientific and commercial information; the current status of SONCC coho salmon, CC Chinook salmon, and NC steelhead; the current status and value of their critical habitats; the environmental baseline for the action area; the effects of the proposed restoration projects; and the cumulative effects; it is NMFS's opinion that the proposed Program 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 the SONCC coho salmon, CC Chinook salmon, or NC steelhead. NMFS also concluded that the project, as proposed, is not likely to adversely affect: (1) southern DPS of Pacific Eulachon, Southern DPS of Green Sturgeon, or Southern Resident Killer Whales; or (2) designated critical habitat for Southern eulachon, or Southern Green Sturgeon.

XI. INCIDENTAL TAKE STATEMENT

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

ESA provided that such taking is in compliance with the terms and conditions of this incidental take statement.

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

A. Amount or Extent of Take

NMFS expects the proposed project will result in incidental take of listed SONCC coho salmon, CC Chinook salmon, and NC steelhead during the 10-year timeframe. Juvenile coho salmon, steelhead and to a lesser extent stream-type juvenile Chinook salmon will be harmed, injured, or killed from the dewatering and fish relocating activities at the project sites. Specifically, incidental take is expected to be in the form of capture during dewatering and fish relocation activities. NMFS expects no more than 766 juvenile SONCC coho salmon will be annually captured, 0.6 percent of the captured coho salmon will be injured each year, and 0.6 percent of the captured coho salmon will be killed each year. NMFS expects no more than 1502 juvenile NC steelhead will be annually captured, 0.7 percent of the captured steelhead will be injured each year, and 0.6 percent of the captured fish killed each year. NMFS expects no more than 5 juvenile CC Chinook will be captured, and one of those captured Chinook salmon will be injured or killed each year.

B. Effect of the Take

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

C. Reasonable and Prudent Measures

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

1. Measures shall be taken to minimize the amount or extent of incidental take of listed salmonids resulting from fish relocation, dewatering, or instream construction activities.

2. Measures shall be taken to ensure that individual restoration projects authorized annually through the Program will minimize take of listed salmonids, monitor and report take of listed salmonids, and to obtain specific project information to better assess the effects and benefits of salmonid restoration projects authorized through the Program.

3. Measures shall be taken to handle or dispose of any individual SONCC coho salmon, CC Chinook salmon, or NC steelhead actually taken (mortality).

D. Terms and Conditions

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

1. The following terms and conditions implement Reasonable and Prudent Measure No. 1, which states that measures shall be taken to minimize the amount or extent of incidental take of listed salmonids resulting from fish relocation, dewatering, or instream construction activities:

    a. Fish relocation data must be provided annually as described in Term and Condition 2b (below). Any injuries or mortality from a fish relocation site that exceeds one percent[7] of a listed species shall be reported to the nearest NMFS office within 48 hours and relocation activities shall cease until a NOAA RC biologist is on site to supervise the remainder of relocation activities.

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

    a. The NOAA RC and/or the Corps shall provide NMFS annual notification of projects that are authorized through the Program. The notification shall be submitted at least 14 days prior to project implementation and must contain specific project information (name of project, type of project, location of project

7 Only when injury or mortality exceeds 5 individuals of the affected species, to minimize the need to report when only a small number of listed species are injured or killed from a small total capture size.

including:, creek, HUC-10 [5th field] watershed, city or town, and county). The annual notification shall be submitted to the Northern California NMFS office:

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

b. In order to monitor the impact to, and to track incidental take of listed salmonids, the NOAA RC and/or the Corps must annually submit to NMFS a report of the previous year's restoration activities. The annual report shall include a summary of the specific type and location of each project, stratified by individual project, 5th field HUC and affected species and ESU/DPS. The report shall include the following project-specific summaries, stratified at the individual project, 5th field HUC and ESU level:

- A summary detailing fish relocation activities, including the number and species of fish relocated and the number and species injured or killed. Any capture, injury, or mortality of adult salmonids or half-pounder steelhead will be noted in the monitoring data and report. Any injuries or mortality from a fish relocation site that exceeds 3 percent of the affected listed species shall have an explanation describing why.

- The number and type of instream structures implemented within the stream channel.

- The length of streambank (feet) stabilized or planted with riparian species.

- The number of culverts replaced or repaired, including the number of miles of restored access to unoccupied salmonid habitat.

- The distance (miles) of road decommissioned.

- The distance (feet) of aquatic habitat disturbed at each project site.

This report shall be submitted annually by March 1 to the Northern California NMFS office:

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

3. The following Term and Condition implements reasonable and prudent measure No. 3, which states that Measures shall be taken to handle or dispose of any individual SONCC coho salmon, CC Chinook salmon, or NC steelhead actually taken (mortality).

   a. All steelhead, Chinook salmon, and coho salmon mortalities must be retained, placed in an appropriately sized whirl-pak or zip-lock bag, labeled with the date and time of collection, fork length, location of capture, and frozen as soon as possible. Frozen samples must be retained until specific instructions are provided by NMFS.

XII. REINITIATION NOTICE

This concludes formal consultation on the actions outlined in the proposed Program to facilitate implementation of fisheries restoration projects in the Northern California region. As provided in 50 CFR § 402.16, reinitiation of formal consultation is required where discretionary Federal involvement or control over the action has been retained or is authorized by law and if: (1) the amount or extent of incidental take is exceeded, (2) new information reveals effects of the action that may affect listed species in a manner or to an extent not previously considered in this opinion, (3) the action is subsequently modified in a manner that causes an effect to the listed species is not considered in this opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action. In instances where the amount or extent of incidental take is exceeded, formal consultation shall be reinitiated immediately.

XIII. CONSERVATION RECOMMENDATIONS

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

1. The NOAA RC and/or the Corps should ensure that disturbed and compacted areas will be revegetated with native plant species at the earliest dormant window (late fall through end of winter) following completion of each authorized project. The plant species used

should be specific to the project vicinity or the region of the state where the project is located, and comprise a diverse community structure (plantings should include both woody and herbaceous species). Plant at a minimum ratio of 3 plantings to 1 removed woody plant. Unless otherwise specified, the standard for success is 80 percent survival of plantings or 80 percent ground cover for broadcast planting of seed after a period of 3 years. Revegetation sites will be monitored yearly in spring or fall months for three years following completion of the project. All plants that have died will be replaced during the next planting cycle (generally the fall or early spring) and monitored for a period of three years after planting.

2. The NOAA RC and/or the Corps should incorporate project data into a format compatible with the CDFG/NMFS/Pacific Fisheries Management Council Geographic Information System (GIS) database, ultimately allowing scanned project-specific reports and documents to be linked graphically within the GIS database.

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

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Enclosure 2

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

The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established new requirements for "Essential Fish Habitat" (EFH) descriptions in Federal fishery management plans and required 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 Corps' administration of the implementation of fisheries restoration activities on private and public lands will affect streams within the regulatory jurisdiction of Corps' San Francisco District in the Mendocino (limited to the Eel River portion of Mendocino County), Humboldt, Del Norte, Siskiyou, and Trinity counties, California, which have been designated EFH for salmon.

Only species managed under a Federal fishery management plan are covered under the MSFCMA. Coho and Chinook salmon are managed under Federal fishery management plans, whereas steelhead are not managed. Therefore, these EFH Conservation Recommendations address only coho and Chinook salmon and do not address steelhead. Pacific groundfish and coastal pelagics will not be affected by the proposed action and are not considered in this consultation.

I. LIFE HISTORY AND HABITAT REQUIREMENTS

Detailed information on the life history and habitat requirements for coho and Chinook salmon is available in the Status of the Species section of the accompanying biological opinion, as well as NMFS status reviews of west coast salmon from Washington, Oregon, and California (Weitkamp *et al*. 1995; Meyers *et al*. 1998; NMFS 2001, 2003; Good *et al*. 2005). In addition, the associated biological opinion for the proposed action summarizes the life history and habitat requirements for coho and Chinook salmon.

II. PROPOSED ACTION

The NOAA RC proposes to fund restoration projects in Humboldt, Del Norte, Trinity, Siskiyou, and a part of Mendocino counties, and the Corps proposes to issue permits under section 10 of the Rivers and Harbors Act of 1899, section 404 of the Federal Water Pollution Control Act, as amended (Clean Water Act (CWA)), or both, from 2012 through 2022. This action will apply to portions of the following counties within coastal counties that are within the regulatory jurisdictional boundaries of the Corps' San Francisco District: Mendocino, Humboldt, Del Norte, Siskiyou, and Trinity. Restoration activities typically occur in watersheds subjected to significant levels of logging, road building, urbanization, mining, grazing, and other activities that have reduced the quality and quantity of instream habitat available for native anadromous salmonids.

Types of authorized projects include: instream habitat improvement, fish passage improvement (including construction of new fish ladders/fishways and maintenance of existing ladders), bank stabilization, riparian restoration, upslope restoration, instream flow augmentation, off channel habitat construction and fish screen installation and maintenance. The majority of the actions considered in this BO follow those described in CDFG's *California Salmonid Stream Habitat Restoration Manual, Third Edition, Volume II* with three new chapters *(Part IX: Fish Passage Evaluation at Stream Crossings, Part X: Upslope Assessment and Restoration Practices, and Part XI: Riparian Habitat Restoration*) added in 2003 and 2004 (Flosi *et al.* 1998), NMFS' *Guidelines for Salmonid Passage at Stream Crossings* (NMFS 2000), and NMFS' *Fish Screening Criteria for Anadromous Salmonids* (NMFS 1997).

III. EFFECTS OF THE PROJECT ACTION

EFH will likely be adversely affected by implementation of the Program. As described and analyzed in the accompanying biological opinion, NMFS anticipates some short-term sediment and turbidity will occur up to about 1500 feet downstream of the project locations. Increased turbidity could further degrade already degraded habitat conditions in many of the proposed project locations. Flowing water may be temporarily diverted up to 500 feet around some projects, resulting in short-term loss of habitat space and short-term reductions in macro-invertebrates (food for salmon). Chemical spills from construction equipment may occur, but NMFS believes the chance of spills is low based on the avoidance and minimization measures to be implemented when heavy construction equipment is used.

The duration and magnitude of direct effects to EFH associated with implementation of individual conservation projects will be significantly minimized due to the multiple minimization measures utilized during project implementation. The temporal and spatial scales at which individual restoration project activities are expected to occur in the next ten years of the proposed action will likely preclude significant additive effects. Implementation of the proposed restoration activities is expected to improve the function and value of EFH and short-term adverse effects will be offset by anticipated long-term benefits.

IV. CONCLUSION

After reviewing the effects of the project, NMFS concludes that the project action, as proposed, will adversely affect the EFH of coho or Chinook salmon within streams currently or historically supporting these species in Mendocino, Humboldt, Del Norte, Siskiyou, and Trinity counties.

V. EFH CONSERVATION RECOMMENDATIONS

Section 305(b)(4)(A) of the MSFCMA authorizes NMFS to provide EFH Conservation Recommendations that will minimize adverse effects of an activity on EFH. Although there may be temporary adverse affects associated with the discharge of pollutants being authorized by the Proposed Action, the quality of EFH will be enhanced over the long term and thus NMFS provides no conservation recommendations.

VI. 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 at least 10 days prior to permit issuance.

VIII. LITERATURE CITED

Flosi, G., S. Downie, J. Hopelain, M. Bird, R. Coey, and B. Collins. 1998. California Salmonid Stream Habitat Restoration Manual. Third Edition. Inland Fisheries Division. California Department of Fish and Game. Sacramento, California.

Good, T. P., R. S. Waples, and P. Adams (editors). 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Dept. of Commerce, NOAA Tech. Memo. NMFS-NWFSC-66. 597 pp.

Meyers, J. M., R. G. Kope, G. J. Bryant, D. Teel, L. J. Lierheimer, T. C. Wainwright, W. S. Grant, F. W. Waknitz, K. Neely, S. T. Lindley, and R. S. Waples. 1998. Status Review of Chinook Salmon from Washington, Idaho, Oregon, and California. United States Department of Commerce, NMFS Technical Memorandum NMFS-NWFSC-35, 443 pp.

National Marine Fisheries Service. 1997. Fish Screening Criteria for Anadromous Salmonids. NOAA Fisheries Southwest Region, January.

National Marine Fisheries Service. 2000. Final Draft. Guidelines for Salmonids Passage at Stream Crossings. Southwest Region. May 16, 2000.

National Marine Fisheries Service. 2001. Status review update for coho salmon (Oncorhynchus kisutch) from the Central California Coast and the California

Portion of the Southern Oregon/Northern California Coast Evolutionarily Significant Units. Southwest Fisheries Science Center, Santa Cruz Laboratory. April 12. 43 pp.

National Marine Fisheries Service. 2003. Preliminary conclusions regarding the updated status of listed ESUs of West Coast salmon and steelhead. February 2003 Co-manager review draft.

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

Enclosure 3

Number of sediment producing projects authorized in each watershed per year (culvert and dam removals, road decommissioning and upgrades, and off channel habitat enhancements).

HUC 10 Watershed Name	Area (sq. miles)	Sediment Projects	States
Middle Fork Smith River	130.83	4	CA,OR
South Fork Smith River	291.97	6	CA
Smith River-Frontal Pacific Ocean	138.63	4	CA
Point St George-Frontal Pacific Ocean	77.32	3	CA
Redwood Creek	282.38	6	CA
Upper Mad River	120.48	4	CA
Middle Mad River	88.22	3	CA
Lower Mad River	285.62	6	CA
Big Lagoon-Frontal Pacific Ocean	153.42	5	CA
Humboldt Bay-Frontal Pacific Ocean	220.76	5	CA
Rice Fork	96.36	3	CA
Corbin Creek-Eel River	192.45	5	CA
Tomki Creek	64.24	3	CA
Outlet Creek	161.82	5	CA
Bucknell Creek-Eel River	193.65	5	CA
Black Butte River	161.86	5	CA
Upper Middle Fork Eel River	204.93	5	CA
Mill Creek	99.34	3	CA
Elk Creek	115.52	4	CA
Lower Middle Fork Eel River	171.14	5	CA
North Fork Eel River	282.59	6	CA
Woodman Creek-Eel River	166.40	5	CA
Dobbyn Creek	74.88	3	CA
Chamise Creek-Eel River	196.84	5	CA
Basin Creek-Eel River	83.03	3	CA
Larabee Creek	87.92	3	CA
Upper Van Duzen River	85.38	3	CA
Yager Creek	137.02	4	CA
Lower Van Duzen River	205.92	5	CA
Price Creek-Eel River	112.12	4	CA
Salt River-Eel River	96.88	3	CA
Upper South Fork Eel River	203.46	5	CA
East Branch South Fork Eel River	76.09	3	CA
Middle South Fork Eel River	156.86	5	CA
Lower South Fork Eel River	252.32	6	CA
Bear River	82.74	3	CA
Mattole River	296.40	6	CA
Cape Mendicino-Frontal Pacific Ocean	55.93	3	CA
Cooksie Creek-Frontal Pacific Ocean	64.77	3	CA
Cottonwood Creek	99.24	3	CA,OR

Bogus Creek-Klamath River	174.08	5	CA
Humbug Creek-Klamath River	106.29	4	CA
Beaver Creek	108.76	4	CA,OR
Horse Creek-Klamath River	154.08	5	CA
Seiad Creek-Klamath River	127.67	4	CA
Lake Shastina-Shasta River	126.13	4	CA
Willow Creek	87.71	3	CA
Little Shasta River	127.29	4	CA
Parks Creek-Shasta River	328.73	6	CA
Yreka Creek-Shasta River	123.57	4	CA
East Fork Scott River	115.43	4	CA
French Creek-Scott River	180.03	5	CA
Moffett Creek	123.22	4	CA
Kidder Creek-Scott River	122.99	4	CA
Indian Creek-Scott River	119.34	4	CA
Lower Scott River	152.50	5	CA
Indian Creek	134.69	4	CA
Thompson Creek-Klamath River	105.04	4	CA
Elk Creek	95.05	3	CA
Clear Creek	111.40	4	CA
Dillon Creek	73.11	3	CA
Ukonom Creek-Klamath River	137.32	4	CA
Rock Creek-Klamath River	108.61	4	CA
Bluff Creek-Klamath River	273.10	6	CA
Blue Creek	125.43	4	CA
Tectah Creek-Klamath River	260.31	6	CA
Turwar Creek-Klamath River	106.28	4	CA
South Fork Salmon River	289.98	6	CA
North Fork Salmon River	203.74	5	CA
Wooley Creek	148.62	4	CA
Salmon River	108.36	4	CA
Browns Creek	73.55	3	CA
Weaver Creek-Trinity River	221.75	5	CA
Canyon Creek	64.06	3	CA
North Fork Trinity River	152.20	5	CA
New River	233.56	5	CA
Big French Creek-Trinity River	270.03	6	CA
Horse Linto Creek-Trinity River	302.96	6	CA
Upper South Fork Trinity River	115.03	4	CA
Upper Hayfork Creek	165.04	5	CA
Lower Hayfork Creek	221.95	5	CA
Middle South Fork Trinity River	227.64	5	CA
Lower South Fork Trinity River	201.73	5	CA
North Fork Smith River	157.97	5	CA,OR

Cape Ferrelo Frontal	61.54	3	CA,OR
Winchuck River	71.25	3	CA,OR

Enclosure 4

Sample Application and Monitoring Checklists

Application Date:

Expected Project Start Date:

Expected Project End Date:

Project Name:

Project Location:

Applicant Name:

Landowner Name:

Stream:

Watershed (per Calwater 2.2.1):

GPS Location (indicate latitude longitude decimal degrees):

Describe current problem, solution and proposed benefits of your project.				
Describe methods of implementation (*i.e.*, hand crews, heavy equipment, chain saws).				
What minimization and avoidance measures will be implemented for this project.				
	Yes	**No**	**N/A**	**Notes**
Salmonid Species Present:				
1. Steelhead				
1.a. Northern California (NC) steelhead				
2.a. Central California Coast (CCC) steelhead				
3.a. South-Central California Coast (SCCC) steelhead				
2. Coho				
1.a. Southern Oregon / Northern California Coast (SONCC) coho				
2.a. Central California Coast (CCC) coho				
3. Chinook				
1.a. California Coastal (CC) chinook				
Project Types Requiring Additional Oversight:				

1. Please indicate if the project includes any of the following:				
1.a. Culvert retrofit and installation				
	Yes	**No**	**N/A**	**Notes**
1.b. Construction of new fish ladders				
1.c. Retrofitting of older fish ladders				
1.d. Removal of flashboard dams				
2. For stream crossing projects, does the proposed project pass all life stages of covered salmonid species that historically passed there? (Section II.A.4)				
2.a. Supporting documentation provided				
3. Proposed retrofit culverts meet the fish passage criteria for the passage needs of the listed species and life stages historically passing through the site prior to the existence of the road crossing (Section II.A.4)				
3.a. Supporting documentation provided				
4. Designs for fish ladders and culvert replacement or modifications are designed and stamped by a registered engineer. (Section II.A.4)				
4.a. Supporting documentation provided				
5. For fish ladder projects verify the following: (Section II.A.4 & Appendix 1.J)				
5.a. Fish ladder is less than 30 feet in height. (Section II.A.4)				
5.b. New ladder is designed to provide passage conditions suitable for year round bidirectional juvenile salmonid movement (Section II.A.4)				
5.c. New ladders have a maximum jump of six inches (Section II.A.4)				
5.d. Documentation of NMFS/CDFG written sign-off				
General Protection Measures:				
6. For fish screen installation, verify the following:				
6.a. Fish screen complies with NMFS/CDFG fish screen criteria				
6.b. Documentation of written sign off				
7. For placement of weirs and concrete lined channels				
7.a. Documentation of NMFS/CDFG written engineering sign off				
8. Verify that construction activities will occur between June 15 to October 15 (Appendix 1.A.5)				
9. Will construction occur within 200 feet of established				

riparian vegetation or other bird nesting habitats? (Appendix 1.A.5)				
9.a. If yes, verify that construction will start after August 1				
10. If poured concrete is used it shall be excluded from the wetted channel for a period of 30 days after it is poured or will be coated with appropriate sealant (Appendix 1.A.6)				
11. Rock used for bank stabilization or to anchor LWD structures, will be large and heavy enough to remain stationary under the 100 year median February flow event (Appendix 1.A.8)				
12. Verify that disturbance footprint of the projects staging areas will not exceed 0.25 acres (Section II.C.1.b)				
13. Will the project require dewatering of the work site?				
13.a. If yes, has (or will) the project proponent coordinated the project site dewatering with a qualified biologist to perform fish and amphibian relocation activities? The qualified biologist(s) must possess a valid State of California Scientific Collection Permit as issued by the CDFG and will be familiar with the life history and identification of listed salmonids and listed herptiles within the action area (Appendix 1.B.1.d)				
13.b. The length of stream dewatered does not exceed 300 feet (Section II.C.1.a)				
	Yes	**No**	**N/A**	**Notes**
14. The requirements outlined in the Program Description section entitled, *"General Conditions for all Fish Capture and Relocation Activities"* have been reviewed and applicable measures will be adhered to during implementation of the project (Appendix 1.B)				
14.a. Supporting documentation provided				
Measures to Minimize Disturbance from Instream Construction:				
15. The requirements outlined in the Program Description section				

entitled *"Measures to Minimize Disturbance from Instream Construction"* have been reviewed and applicable measures will be adhered to during implementation of the project (Appendix 1.D)				
15.a. Supporting documentation required				
Measures to Minimize Degradation of Water Quality:				
16. The requirements outlined in the Program Description section entitled *"Measures to Minimize Degradation of Water Quality"* have been reviewed and applicable measures will be adhered to during implementation of the project (Appendix 1.E.)				
16.a. Supporting documentation provided				
Measures to Minimize Loss or Disturbance of Riparian Vegetation:				
17. Native trees with defects, large snags > 16 inches (in) diameter breast height (dbh) and 20 ft high, cavities, leaning toward the stream channel, with active bird nests, late seral characteristics, or > 36 in dbh will be retained (Section II.C.1.b)				
17.a. All other applicable requirements outlined in *"Measures to Minimize Loss or Disturbance of Riparian Vegetation"* have been reviewed and applicable measures will be adhered to during project implementation (Appendix 1.H.)				
17.b. Supporting documentation provided				
18. Downed trees (logs) > 24 in dbh and 10 ft long will also be retained on upslope sites (Section II.C.1.b)				
Measures to Minimize Impacts to Non-Surfaced Roads in Project Area:				
19. The requirements outlined in the Program Description section entitled *"Measures to Minimize Impacts to Non-Surfaced Roads in Project Area"* have been reviewed and applicable measures will be adhered to during implementation of the project (Appendix 1.I)				
19.a. Supporting documentation provided				
Additional Project Information:				
20. Does the project propose the use of gabion baskets?				
21. Does the project propose use of cylindrical riprap				

(aqualogs)?				
22. Does the project propose use of chemically-treated timbers for grade or channel stabilization structures, bulkheads or other instream structures?				
23. Will the completed project substantially disrupt the movement of aquatic species indigenous to the waterbody, including those species that normally migrate through the action area?				
24. Will the project completely eliminate a riffle/pool complex?				
25. Does the project proponent propose to dewater more than 300 ft of stream?				
26. Does the project propose use of undersized rock within ordinary high water (rock incapable of withstanding a 100 year flow event)?				
Monitoring (Appendix 2.A):				
27. Pre-project photos attached (from minimum of four cardinal directions)				
28. The project applicant has reviewed all monitoring requirements necessary for coverage under this biological opinion and will submit reports as required	**Initials:**			

Please provide an explanation of any proposed deviations from the Program requirements as an attachment.

Signature:
By signing below, I certify all of the information indicated above is accurate. I have also reviewed the project description and terms and conditions of the biological opinion, and agree to comply:

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Applicant Date