North-Central California Coast Recovery Domain

5-Year Review:
Summary and Evaluation of
Central California Coastal Steelhead DPS
Northern California Steelhead DPS

Top photo Russian River CCC steelhead; bottom photo Eel River NC steelhead
Photo courtesy of Joshua Fuller

National Marine Fisheries Service
Southwest Region
Long Beach, CA

5-YEAR REVIEW
North Central California Coast Recovery Domain

Species Reviewed	Evolutionarily Significant Unit or Distinct Population Segment
CCC Steelhead (*O. mykiss*)	**Central California Coast Steelhead DPS**
NC Steelhead (*O. mykiss*)	**Northern California Steelhead DPS**

1.0 GENERAL INFORMATION

1.1 Reviewers

1.1.1. Southwest Region (SWR)

Preparers:

Melanie Harrison[1] (707) 575-1253 *Melanie.Harrison@noaa.gov*

Reviewers:

Craig Wingert[2] (562) 980-4021 *Craig.Wingert@noaa.gov*

Dick Butler[1] (707) 575-6058 *Dick.butler@noaa.gov*

[1]North Central Coast Office, Protected Resources Division, 777 Sonoma Avenue, Room 325, Santa Rosa, California 95404

[2] Regional Offices, 501 West Ocean Boulevard, Suite 4200, Long Beach, California 90802-4250

1.1.2. Southwest Fisheries Science Center (SWFSC)

Status Review Update Report prepared by Thomas H. Williams, Brian C. Spence, Steven T. Lindley, and David A. Boughton [3]

[3] Southwest Fisheries Science Center, 110 Shaffer Road, Santa Cruz, CA 94929-12

1.2 Introduction

Many West Coast salmon and steelhead (*Oncorhynchus* sp.) stocks have declined substantially from their historic numbers and now are at a fraction of their historical abundance. There are several factors that contribute to these declines, including: overfishing, loss of freshwater and estuarine habitat, hydropower development, poor ocean conditions, and hatchery practices. These factors collectively led to the National Marine Fisheries Service (NMFS) listing of 28 salmon and steelhead stocks in California, Idaho, Oregon, and Washington under the Federal Endangered Species Act (ESA).

The ESA, under Section 4(c)(2), directs the Secretary of Commerce to review the listing classification of threatened and endangered species at least once every five years. After completing this review, the Secretary must determine if any species should be: (1) removed from the list; (2) have its status changed from threatened to endangered; or (3) have its status changed from endangered to threatened. The most recent listing determinations for west coast salmon and steelhead occurred in 2005 (70 FR 37160) and 2006 (71 FR 834), respectively. This document summarizes NMFS's 5-year reviews for the threatened Central California Coast (CCC) steelhead and Northern California (NC) steelhead Distinct Population Segments (DPSs).

1.2.1 Background on Listing Determinations

Under the ESA, a species, subspecies, or a distinct population segment (DPS) may be listed as threatened or endangered. To identify the proper taxonomic unit for consideration in an ESA listing for salmon, NMFS uses the "Policy on Applying the Definition of Species under the ESA to Pacific Salmon" (ESU Policy) (56 FR 58612). According to this policy guidance, populations of salmon substantially reproductively isolated from other con-specific populations and representing an important component in the evolutionary legacy of the biological species are considered to be an ESU. In the listing determinations for Pacific salmon under the ESA, NMFS defined an ESU as constituting a DPS, and hence a ''species.''

In 2006, NMFS applied the joint U.S. Fish and Wildlife Service-National Marine Fisheries Service distinct population segment (DPS) policy (61 FR 4722) rather than the agency's ESU policy for the delineation of West Coast steelhead (*O. mykiss*) DPSs under the ESA. Under this policy, a DPS of steelhead must be discrete from other con-specific populations, and it must be significant to its taxon. A group of organisms is discrete if it is ''markedly separated from other populations of the same taxon as a consequence of physical, physiological, ecological, and behavioral factors" (61 FR 4722). According to the DPS policy, if a population group is determined to be discrete, NMFS must then consider whether it is significant to the taxon to which it belongs. Considerations in evaluating the significance of a discrete population segment include: (1) persistence of the discrete population segment in an unusual or unique ecological setting for the taxon; (2) evidence that the loss of the discrete population segment would cause a significant gap in the taxon's range; (3) evidence that the discrete population segment represents the only surviving natural occurrence of a taxon that may be more abundant elsewhere outside its historical geographic range; or (4) evidence that the discrete population segment has marked genetic differences from other population segments of the species.

Artificial propagation (fish hatchery) programs are common throughout the range of ESA-listed West Coast salmon and steelhead. On June 28, 2005, NMFS announced a final policy addressing the role of artificially propagated Pacific salmon and steelhead in listing determinations under the ESA (70 FR 37204). Specifically, this policy: (1) establishes criteria for including hatchery stocks in ESUs and DPSs; (2) provides direction for considering hatchery fish in extinction risk assessments of ESUs and DPSs; (3) requires that hatchery fish determined to be part of an ESU or DPS to be included in any listing of those units; (4) affirms our commitment to conserving natural salmon and steelhead populations and the ecosystems upon which they depend; and (5) affirms our commitment to fulfilling trust and treaty obligations with regard to the harvest of some Pacific salmon and steelhead populations, consistent with the conservation and recovery of listed salmon ESUs and steelhead DPSs.

To determine whether a hatchery program was part of already delineated ESUs or DPSs, NMFS convened the Salmon and Steelhead Hatchery Advisory Group (SSHAG), which evaluated all hatchery stocks and programs and divided them into 4 categories (SSHAGG, 2003) as follows:

Category 1: The hatchery population was derived from a native, local population; is released within the range of the natural population from which is was derived; and has experienced only relatively minor genetic changes from causes such as founder effects, domestication or non-local introgression.

Category 2: The hatchery population was derived from a local natural population, and is released within the range of the natural population from which is was derived, but is known or suspected to have experienced a moderate level of genetic change from causes such as founder effects, domestication, or non-native introgression.

Category 3: The hatchery population is derived predominately from other populations that are in the same ESU/DPS, but is substantially diverged from the local, natural population(s) in the watershed in which it is released.

Category 4: The hatchery population was predominately derived from populations that are not part of the ESU/DPS in question; or there is substantial uncertainty about the origin and history of the hatchery population (70 FR 37160).

Based on these categorical delineations, hatchery programs in SSHAG categories 1 and 2 were included in ESUs and DPSs (70 FR 37160). In some circumstances hatchery programs in other categories were occasionally included in an ESU or DPS as well.

Because the new hatchery listing policy changed the way NMFS considered hatchery fish in ESA listing determinations, NMFS conducted new status reviews and ESA-listing determinations for all West Coast salmon ESUs and steelhead DPSs using this policy. On June 28, 2005, NMFS issued final listing determinations for 16 ESUs of Pacific salmon and on January 5, 2006 NMFS issued final listing determinations for 10 DPSs of steelhead including both the NC and CCC steelhead DPSs.

1.3 Methodology used to complete the review

A public notice initiating this review and requesting information was published on March 18, 2010, with a 60-day public comment period to solicit information from the public and other interested parties (75 FR 13082). Overall, NMFS received very limited comments during the public comment period. NMFS Southwest Fisheries Science Center (SWFSC) and Protected Resources Division (PRD) staff gathered and synthesized updated information regarding the biological status of the two DPSs, their associated hatchery stocks, and the ESA listing factors affecting both DPSs. Key information sources for this review included:

- The final draft Multi-species Recovery Plan under review by the Center for Excellence (CIE) for CCC steelhead and NC steelhead DPSs, and CC Chinook ESU;
- the draft status review update for Pacific Salmon and Steelhead Listed Under the Endangered Species Act: Southwest (Williams et al. 2011);
- peer-reviewed scientific publications;
- the final listing notices for the CCC steelhead (62 FR 43937) and NC steelhead (65 FR 36074) DPSs;
- the final listing notice for delineating the CCC steelhead and NC steelhead DPSs as threatened (71 FR 834);
- the final rule designating critical habitat for the CCC steelhead and NC steelhead DPSs (70 FR 52488);
- the 2005 status update for the CCC steelhead and NC steelhead DPSs (Good et al. 2005) and;
- updated information compiled on hatchery stocks and programs since 2005.

All literature and documents used for this review are on file at the NMFS North Central Coast Office and can also be obtained from the SWR Regional office in Long Beach, California.

1.3 Background – Summary of Previous Reviews, Statutory and Regulatory Actions, and Recovery Planning

1.3.1 FR Notice citation announcing initiation of this review

75 FR 13082; March 18, 2010

1.3.2 Listing history

The CCC steelhead and NC steelhead were originally defined as ESUs and listed as threatened species in 1997 (62 FR 43937) and 2000 (65 FR 36074), respectively (Table 1). At the time of those listings both anadromous (steelhead) and resident (non-anadromous) forms of the species were considered part of each ESU; however, only the anadromous forms were listed (62 FR 43937). A court ruling in 2001 (*Alsea Valley Alliance* v. *Evans*, 161 F. Supp. 2d 1154 (D. Or. 2001)) determined that listing only a subset of a species or ESU/DPS, such as the anadromous portions of the CCC steelhead and NC steelhead ESUs, was not allowed under the ESA. Because of this court ruling, NMFS conducted updated status reviews for all west coast steelhead ESUs that took into account those non-andromous populations below dams and other major migration barriers that were considered to be part of the steelhead ESUs (Good et al., 2005). Subsequently, because of policy differences with the FWS, NMFS decided to use the joint FWS-NMFS DPS policy to delineate steelhead-only DPSs rather than ESUs that included both steelhead and the related non-anadromous forms. Using this DPS policy, NMFS redefined the CCC and NC steelhead ESUs as steelhead-only DPSs and reaffirmed that the steelhead only DPSs were threatened species under the ESA (71 FR 834, January 5, 2006).

Table 1. Summary of the listing history under the ESA for CCC and NC steelhead DPSs.

Salmonid Species	ESU/DPS Name	Original Listing	Revised Listing(s)
Steelhead (*O. mykiss*)	CCC Steelhead DPS	**FR notice:** 62 FR 43937 **Date:** 8/18/1997 **Classification:** Threatened	**FR notice:** 71 FR 834 **Date:** 1/05/2006 **Re-classification:** Reaffirmed threatened
Steelhead *(O. mykiss)*	NC Steelhead DPS	**FR notice:** 65 FR 36074 **Date:** 6/7/2000 **Classification:** Threatened	**FR notice:** 71 FR 834 **Date:** 1/5/ 2006 **Re-classification:** Reaffirmed threatened

1.3.3 Associated rulemakings

Section 4(d) of the ESA directs NMFS to issue regulations to conserve species listed as threatened. This applies particularly to "take," which can include any act that kills or injures fish, and may include habitat modification. The ESA prohibits any take of species listed as endangered, but some take of threatened species that does not interfere with survival and recovery can be allowed. NMFS originally promulgated 4(d) protective regulations for CCC steelhead in 2000 and NC steelhead in 2002, respectively, and then subsequently modified those regulations in 2005 (Table 2).

The ESA requires NMFS to designate critical habitat for any species it lists under the ESA. Critical habitat is defined as: (1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation. NMFS designated critical habitat for the CCC and NC steelhead DPSs in 2005 (Table 2).

Table 2. Summary of rulemaking for 4(d) protective regulations and critical habitat for NC and CCC steelhead DPSs.

Salmonid Species	ESU/DPS Name	4(d) Protective Regulations	Critical Habitat Designations
Steelhead *(O. mykiss)*	CCC Steelhead DPS	**FR notice:** 65 FR 42422 **Date:** 7/10/2000 **Revised**: 6/28/2005 (70 FR 37160)	**FR notice:** 70 FR 52488 **Date:** 9/2/2005
Steelhead *(O. mykiss)*	NC Steelhead DPS	**FR notice:** 67 FR 1116 **Date**: 1/9/2002 **Revised**: 6/28/2005 (70 FR 37160)	**FR notice:** 70 FR 52488 **Date:** 9/2/2005

1.3.4 Review History

Numerous scientific assessments have been conducted to assess the biological status of these two DPSs (Table 3). The majority of these assessments have been completed since the last 5-year status review (Good et al. 2005).

Table 3. Summary of previous scientific assessments for the CCC steelhead and NC steelhead DPSs.

Salmonid Species	ESU/DPS Name	Document Citation
Steelhead *(O. mykiss)*	CCC Steelhead DPS	
		Busby, P. J., T. C. Wainwright, G.J. Bryant, L.J. Lierheimer, R.S. Waples, F.W. Waknitz and I.V. Lagomarsino. 1996. Status review of West Coast steelhead from Washington, Idaho, Oregon, and California. U.S. Department of Commerce, NOAA Technical Memorandum, NMFS-NWFSC-27. 261 pp.
		Good, T. P., R. S. Waples and P. B. Adams. 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, NMFS-NWFSC-66. 598 pp.
		Bjorkstedt, E. P., B. C. Spence, J. C. Garza, D. G. Hankin, D. Fuller, W. E. Jones, J. J. Smith and R. Macedo. 2005. An analysis of historical population structure for evolutionarily significant units of Chinook salmon, coho salmon, and steelhead in the north-central California coast recovery domain. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center, NOAA-TM-NMFS-SWFSC-382. 210 pp.
		Spence, B. C., E. P. Bjorkstedt, J. C. Garza, J.J. smith, D.G. Hankin, D. Fuller, W. E. Jones, and R. Macedo, T.H. Williams, and E. Mora. 2008. A framework for assessing the viability of threatened and endangered salmon and steelhead in the north-central California coast recovery domain. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries

		Service, Southwest Fisheries Science Center, NOAA-TM-NMFS-SWFSC-423. 173 pp.
		Williams, T.H, S.T. Lindley, B.C. Spence and D.A. Boughton. 2011. Status review update for Pacific salmon and steelhead Listed Under the Endangered Species Act: Southwest. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center NOAA-TM-NMFS-SWFSC-XXX. XX pp. (Internal Draft May, 2011)
Steelhead *(O. mykiss)*	NC Steelhead DPS	
		Busby, P. J., T. C. Wainwright, G.J. Bryant, L.J. Lierheimer, R.S. Waples, F.W. Waknitz and I.V. Lagomarsino. 1996. Status review of West Coast steelhead from Washington, Idaho, Oregon, and California. U.S. Department of Commerce, NOAA Technical Memorandum, NMFS-NWFSC-27. 261 pp.
		Adams, P. 2000. Status review update for the steelhead Northern California Evolutionarily Significant Unit. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center. 14 pp.
		Good, T. P., R. S. Waples and P. B. Adams. 2005. Updated status of federally listed ESUs of West Coast salmon and steelhead. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, NMFS-NWFSC-66. 598 pp.
		Bjorkstedt, E. P., B. C. Spence, J. C. Garza, D. G. Hankin, D. Fuller, W. E. Jones, J. J. Smith and R. Macedo. 2005. An analysis of historical population structure for evolutionarily significant units of Chinook salmon, coho salmon, and steelhead in the north-central California coast recovery domain. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center, NOAA-TM-NMFS-SWFSC-382. 210 pp.
		Spence, B. C., E. P. Bjorkstedt, J. C. Garza, J.J. smith, D.G. Hankin, D. Fuller, W. E. Jonesand R. Macedo, T.H. Williams, and E. Mora. 2008. A framework for assessing the viability of threatened and endangered salmon and steelhead in the north-central California coast recovery domain. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center, NOAA-TM-NMFS-SWFSC-423. 173 pp.
		Williams, T.H, S.T. Lindley, B.C. Spence, and D.A. Boughton. 2011. Status review update for Pacific salmon

		and steelhead Listed under the Endangered Species Act: Southwest. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southwest Fisheries Science Center NOAA-TM-NMFS-SWFSC-XXX. XX pp. (Internal Draft May, 2011)

1.3.5 Species' Recovery Priority Number at start of 5-year review

NMFS issued guidelines in 1990 (55 FR 24296) for assigning listing and recovery priorities. Three criteria are assessed to determine a species' priority for recovery plan development, implementation, and resource allocation: 1) magnitude of threat; 2) recovery potential; and 3) existing conflict with activities such as construction and development. The current recovery priority numbers for the two DPSs, as reported in the *2008-2010 Biennial Report to Congress on the Recovery Program for Threatened and Endangered Species (available at:* http://www.nmfs.noaa.gov/pr/pdfs/laws/esabiennial2010.pdf*)*, are listed in Table 4 (NOAA, 2010a).

1.3.6 Recovery Outline and Plan

Recovery outlines were developed for both DPSs in 2007 (Table 4). A draft multi-species recovery plan is currently under review by the Center for Excellence (CIE) which addresses these two DPSs. NMFS expects a co-managers draft of the multi-species recovery plan to be released for public comment in 2012. Co-managers include, but are not limited to, state, Federal and local agencies and/or organizations, native American Indian tribes, and private entities. NMFS anticipates the multi-species recovery plan will be finalized and released in 2013.

Table 4. Recovery Priority Number and Endangered Species Act Recovery Plans for the DPSs.

Salmonid Species	ESU/DPS Name	Recovery Priority Number	Recovery Outline/Plan
Steelhead *(O. mykiss)*	**CCC Steelhead DPS**	**3**	**2007 Federal Recovery Plan Outline for the Distinct Population Segment of Central California Coast Steelhead (issued May 31, 2007). Available at: http://swr.nmfs.noaa.gov/recovery/FINAL_Steelhead_061507.pdf** **Plan Status:** Draft multi-species recovery plan under review by CIE
Steelhead *(O. mykiss)*	**NC Steelhead DPS**	**5**	**2005 Recovery outline for the Distinct Population Segment of Northern California Steelhead (issued August 16, 2007). Available at: http://swr.nmfs.noaa.gov/recovery/FINAL-2007_Federal_Recovery_Outline_for_the_DPS_of_NC_Steelhead_071607.pdf** **Plan Status:** Draft multi-species recovery plan under review by CIE

2.0 REVIEW ANALYSIS

2.1 Delineation of Species under the Endangered Species Act

2.1.1 Is the species under review a vertebrate?

ESU/DPS Name	YES*	NO**
CCC Steelhead DPS	X	
NC Steelhead DPS	X	

** if "Yes," go to section 2.1.2*
*** if "No," go to section 2.2*

2.1.2 Is the species under review listed as a DPS?

ESU/DPS Name	YES*	NO**
CCC Steelhead DPS	X	
NC Steelhead DPS	X	

** if "Yes," go to section 2.1.3*
*** if "No," go to section 2.1.4*

2.1.3 Was the DPS listed prior to 1996?

ESU/DPS Name	YES*	NO**	Date Listed if Prior to 1996
CCC Steelhead DPS		X	
NC Steelhead DPS		X	

** if "Yes," give date go to section 2.1.3.1*
*** if "No," go to section 2.1.4*

2.1.3.1 Prior to this 5-year review, was the DPS classification reviewed to ensure it meets the 1996 policy standards?

In 1991 NMFS issued a policy on how the agency would delineate DPSs of Pacific salmon for listing consideration under the Endangered Species Act (ESA) (56 FR 58612) as evolutionarily significant units (ESUs). Under this policy a group of Pacific salmon populations is considered an ESU if it is substantially reproductively isolated from other con-specific populations, and it represents an important component in the evolutionary legacy of the biological species. The 1996 joint FWS-NMFS Distinct Population Segment (DPS) policy (61 FR 4722) affirmed that a stock (or stocks) of Pacific salmon is considered a DPS if it represents an ESU of a biological species. Accordingly, in listing the CCC steelhead and NC steelhead ESUs under the ESU policy in 1997 and 2000, respectively, NMFS treated the ESUs as DPSs under the ESA. NMFS considers its ESU policy to be a detailed extension of the joint DPS policy and consequently will continue to use its ESU policy with respect to Pacific salmon. In the case of steelhead (*O. mykiss*), NMFS currently uses the joint DPS policy to delineate steelhead-only DPSs under the ESA. This joint policy was used to delineate and list the CCC and NC steelhead DPSs in 2006 (71 FR 834).

2.1.4 Summary of relevant new information regarding the delineation of the DPSs under review

Maps illustrating the current geographic distribution of the CCC and NC steelhead DPS are shown in Figures 1 and 2. The CCC steelhead DPS comprises winter-run steelhead populations from the Russian River inclusive (Sonoma County), in stream tributaries to the San Francisco/San Pablo Bay system, and stretches south to Aptos Creek (Santa Cruz County), inclusive. The NC steelhead DPS comprises winter- and summer-run steelhead populations from Redwood Creek (Humboldt County) southward to, but not including the Russian River. The current southern boundary of the Klamath Providence at the Klamath River coupled with the northern boundary of the NC steelhead at Redwood Creek leaves an approximately 30 km stretch of coast containing six small coastal streams (e.g., Ossagan Creek, Boat Creek, Fern Creek, Butler, Squashan Creek, and Gold Bluff Creek) with steelhead. The coastal steelhead that inhabit these streams are not in the NC steelhead DPS (Figure 2).

As part of this five year review process, the SWFSC compiled and evaluated new information relevant to the geographic boundaries of all listed ESUs and DPSs in California to determine if potential boundary changes were warranted (Williams et al. 2011). The SWFSC's Molecular Ecology and Genetic Analysis Team has produced substantial amounts of new population genetic data that has contributed to improving our understanding of the population structure of ESA-listed salmonids in California. The new genetic information for CCC and NC steelhead DPSs from Williams et al. (2011) is summarized below.

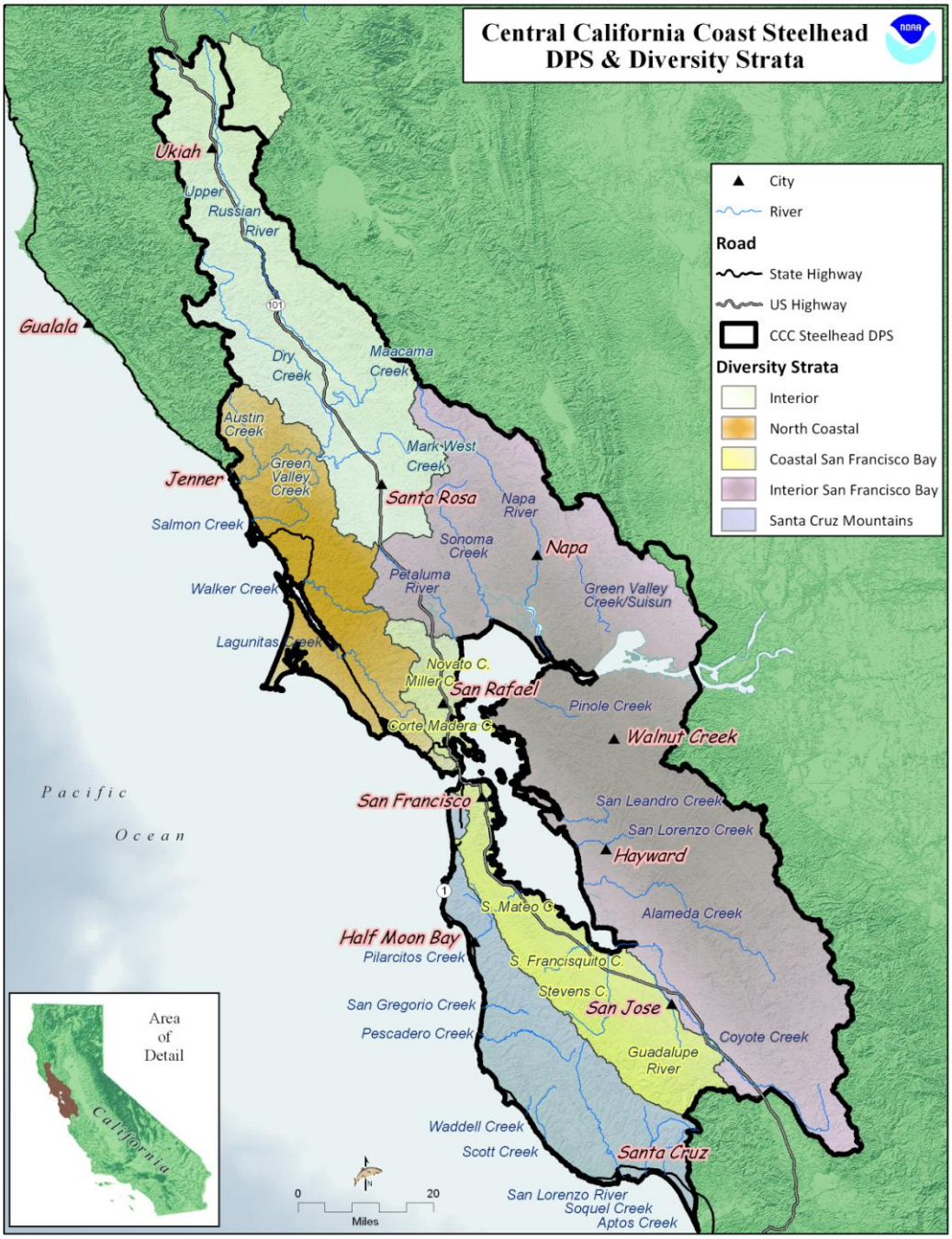

Figure 1. Central California Coast Steelhead DPS and Diversity Strata located in the NCCC Recovery Domain.

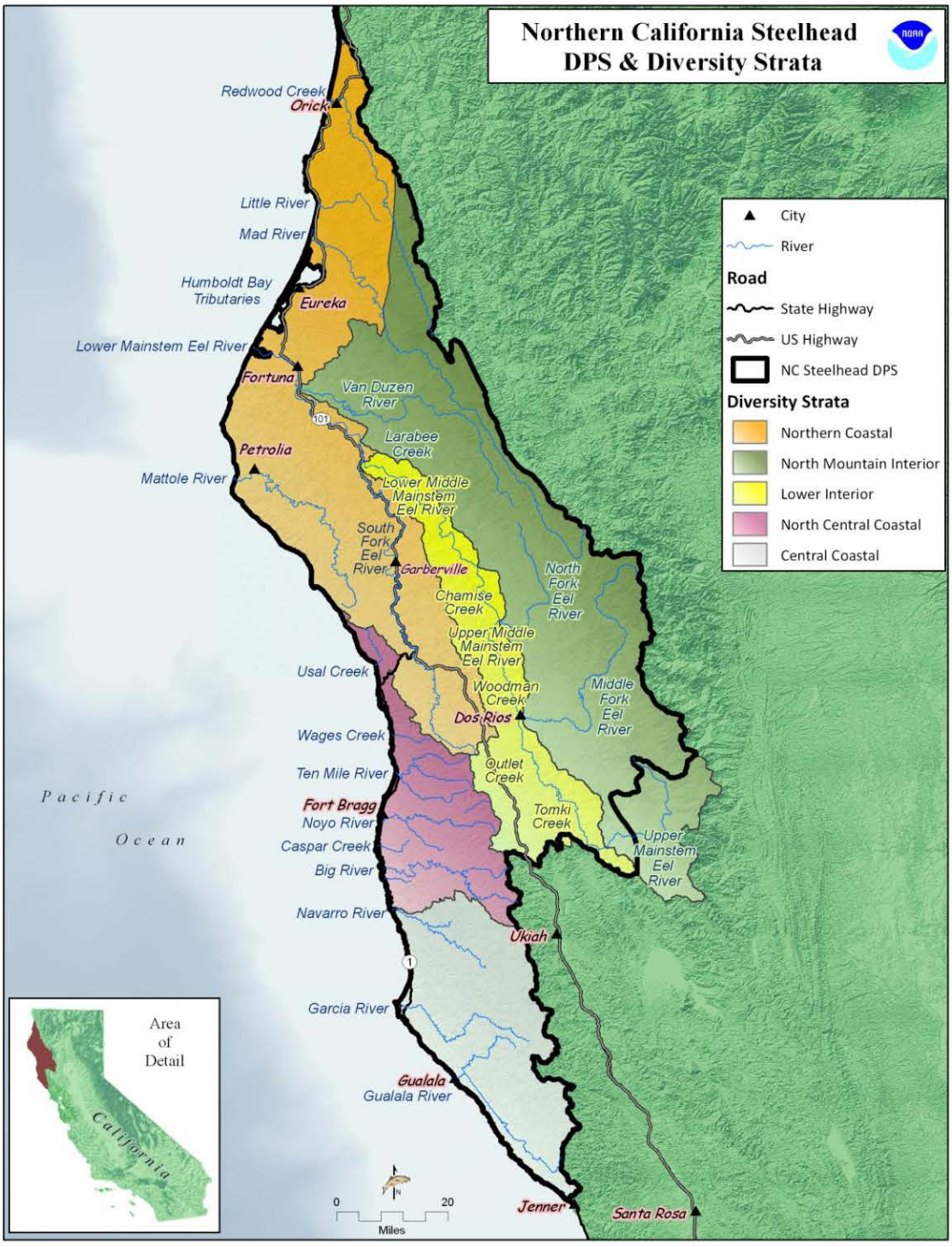

Figure 2. Northern California Steelhead DPS and Diversity Strata located in the NCCC Recovery Domain.

Abundant new genetic data are available for these populations including primarily microsatellite data, single-nucleotide polymorphism (SNP), and mitochondrial DNA (mtDNA) data (Garza et al. 2004, 2008; Clemento et al. 2009; Aguilar et al. unpublished; Pearse et al. in review). These data include a systematic evaluation of populations from the Oregon border to the southern portion of the South Central California Coast DPS. In addition, data has been collected on summer and winter steelhead in the Eel and Klamath/Trinity River Basins using the same microsatellite markers. Subsets of the coastal populations have been assessed with large numbers (89-169) of new SNP markers. One additional dataset that has provided information relevant to assessing DPS boundaries is an analysis of museum specimens collected in 1897 and 1909 by John Otterbein Snyder from populations ranging from the upper Salinas River to the South Fork of the Eel. These specimens only provide information on mtDNA sequences, however these data provides a unique glimpse of historical population structure in the DPSs. The recent genetic data suggest several potential boundary changes may be warranted for coastal California DPSs. For example, Bjorkstedt et al. (2005) presented analyses indicating that genetic boundaries in the northern coastal DPSs coincide with current boundaries between the Northern and Central California Coast DPSs. However, Clemento et al. (2009) found no evidence for a genetic boundary between the two southernmost DPSs.

Based on this new genetic information, the SWR requested the SWFSC convene a biological review team to compile, review, and evaluate the best available scientific and commercial information on steelhead genetics, life history and biology, and the ecological/habitat requirements of steelhead relevant to the boundaries of coastal steelhead DPSs in California. As part of its review, the BRT will also: (1) evaluate to what extent this information does or does not support the current DPS boundaries, and (2) describe how this information independently (e.g., genetics) and collectively (e.g., genetics, life history, and ecological/habitat requirements) support potential alternative DPS boundaries. The existing boundary delineations for the CCC and NC steelhead DPSs were used in this review (71 FR 834).

Hatchery Stocks for CCC Steelhead

CCC steelhead DPS

In conjunction with the most recent status review for the CCC steelhead DPS (Good et al. 2005), NMFS reviewed all available information on hatchery stocks and programs within the range of the DPS. This review and analysis concluded that two artificially propagated hatchery stocks (Don Clausen Fish Hatchery and Scott Creek/The Kingfisher Flat Hatchery) were closely related to naturally spawning populations in the DPS (SSHAG, 2003) based on genetic information, the source of the brood stock, and the hatchery management practices. The hatchery stocks (Don Clausen Fish Hatchery and Scott Creek/The Kingfisher Flat Hatchery) were ultimately included in the listed DPS in 2006 (71 FR 834). As part of the 5-year review we have reevaluated the status of the hatchery stocks and programs to determine whether they are still operational and if so, whether they have been substantially modified. Based on a review of the available information, including discussions with the California Department of Fish and Game (CDFG), we have determined that both hatchery programs continue to be operational and propagate stocks that are part of the DPS.

NC steelhead DPS

In conjunction with the most recent status review for the NC steelhead DPS (Good et al. 2005), NMFS also reviewed available information on hatchery stocks and programs within the range of this DPS. This review and analysis concluded that two out of three artificially propagated hatchery stocks (Yager Creek and North Fork Gualala) were closely related to naturally spawning steelhead populations in the DPS, but were not essential for recovery of the species. The Mad River Hatchery stock was found to be substantially diverged from native and/or natural populations in the watershed (SSHAG, 2003). Yager Creek and North Fork Gualala were not included in the listed DPS when it was reaffirmed as threatened in 2006 (71 FR 834). As part of this 5-year review, we reevaluated the status of the hatchery stocks and programs to determine whether they are still operational and if so, whether they have been substantially modified. Based on a review of the available information, including discussions with the CDFG, we have determined that the Yager Creek Hatchery was terminated following the 2001/2002 season and the North Fork Gualala hatchery program was terminated in 1989. The Mad River continues to be operational, but was not included in the DPS in 2006 (71 FR 834), and since management of the facility has not changed it was not considered in this review.

2.2 Recovery Criteria

2.2.1 Do the species have final, approved recovery plans containing objective, measurable criteria?

ESU/DPS Name	YES	NO
CCC Steelhead DPS		**X**
NC Steelhead DPS		**X**

The ESA requires recovery plans to incorporate (to the maximum extent practicable) objective, measurable criteria which, when met, would result in a determination in accordance with the provisions of the ESA that the species can be removed from the Federal List of Endangered and Threatened Wildlife and Plants (50 CFR 17.11 and 17.12). A draft multi-species recovery plan which addresses three ESA-listed species, CCC steelhead DPS, NC steelhead DPS and CC Chinook salmon ESU, is currently under view by the CIE. The multi-species plan will include the following general types of recovery criteria: (1) population based biological criteria that consider future commercial, recreational and tribal fish harvest; (2) criteria that measure watershed health, (3) criteria that address the abatement and amelioration of threats to the species, and (4) criteria that address the five listing factors (NMFS, 2010). These criteria will reflect the best available and most up-to-date information on the biology of the species and its habitat and require clear evidence that: (1) the status of populations comprising the DPS have improved in response to the reduction of threats, and (2) the threats leading to the species decline and listing have been controlled. The specific criteria related to the status of populations, improvement in watershed conditions, and abatement of threats across the DPS must be met prior to delisting.

2.2.2 Adequacy of recovery criteria.

2.2.2.1 Do the recovery criteria reflect the best available and most up-to date information on the biology of the species and its habitat?

The recovery criteria under development for these DPSs will reflect the best available and most up to date information on their biology and habitat requirements. See discussion in section 2.2.1.

ESU/DPS Name	YES	NO
CCC steelhead DPS	N/A	
NC steelhead DPS	N/A	

2.2.2.2 Are all of the 5 listing factors that are relevant to the species addressed in the recovery criteria?

ESU/DPS Name	YES	NO
Central California Coast steelhead DPS	N/A	
Northern California steelhead DPS	N/A	

The recovery criteria will address all of the 5 listing factors. See discussion in section 2.2.1.

2.2.3 List the recovery criteria as they appear in any final or interim recovery plan, and discuss how each criterion has or has not been met, citing information

Final or interim recovery plans have not been issued and recovery criteria have not been finalized. See discussion above in section 2.2.1 regarding the general nature of the draft criteria.

2.3 Updated Information and Current Species Status

2.3.1 Analysis of Viable Salmonid Population (VSP) Criteria

The VSP criteria define viable salmonid populations using the four parameters of abundance, population growth rate, population spatial structure, and diversity. A key difference between this 5-year review and the last status review (Good et al. 2005) is the current availability of population structure information and population/DPS viability criteria for both the CCC steelhead and NC steelhead DPSs (Bjorkstedt et al. 2005; Spence et al. 2008). Because this important new information is available, the SWFSC's updated status review evaluated all new substantive biological information on these two DPSs within the context of the new population structure information and viability criteria. The following discussion for the CCC steelhead and NC steelhead DPSs is taken primarily from the updated status review by Williams et al. (2011).

CCC Steelhead DPS

Abundance and Trends

Bjorkstedt et al. (2005) concluded that the CCC steelhead DPS historically was comprised of 37 independent populations (i.e., 11 functionally independent and 26 potentially independent) and possibility 30 or more dependent populations of winter-run steelhead. These populations were aggregated into five geographically based diversity strata: North Coastal, Interior, Santa Cruz Mountains, Coastal San Francisco Bay and Interior San Francisco Bay (Bjorkstedt et al. 2005; modified in Spence et al. 2008) (Table 5). Adult viability targets based on intrinsic habitat potential modeling and spawner density estimates were developed by Spence et al. (2008).

The lack of time series data to estimate population level abundance spanning 12 or more years precluded application of the viability criteria to any of the 37 independent populations of CCC steelhead. However, ancillary data on population abundance (time series of adult abundance spanning 4 years) and the high proportion of returning fish of hatchery origin (34%) led the TRT to classify the Scott Creek population as at moderate risk for extinction. In addition, the TRT concluded that many of the populations in the Coastal San Francisco Bay and Interior San Francisco Bay diversity strata including Walnut Creek, San Pablo Creek, San Lorenzo Creek, Alameda Creek, and San Mateo Creek were likely at high risk of extinction due to the loss of the majority of the historical spawning habitat behind impassible barriers, and the heavily urbanized nature of most of these watersheds downstream of barriers.

New Data and Updated Analyses

Currently, there are extremely limited data to assess the status of the CCC steelhead DPS. Monitoring of the Scott Creek population has continued, and the time series data now includes data from 2005-2011. During this time, the total estimated number of steelhead returning to the stream averaged 275 fish (range 126-440) with approximately 35% of hatchery origin. Time series data in Scott Creek also show that steelhead spawners of natural origin have experienced a significant downward decline over time (slope = -0.220; $p = 0.036$) (Williams et al. 2011).

In other areas within the DPS the status of steelhead is highly uncertain. In the North Coastal and Interior strata, there are no population level estimates of abundance and ancillary data is limited. In the Russian River basin, steelhead return in substantial numbers to the Warm Springs Hatchery and Coyote Valley Fish Facility with returns averaging approximately 7,000 fish over the past 10 years. Juvenile hatchery releases during this period have averaged nearly 500,000 fish annually (J. Urrutia, CDFG, Sacramento, CA, unpublished data[1]). However, the lack of spawner surveys on natural spawning grounds within the Upper Russian River basin makes it impossible to assess either population abundance of wild fish or the fraction of hatchery fish occurring on natural spawning grounds. In the San Francisco Bay region (both Interior SF Bay and Coastal SF Bay strata) data for steelhead remain limited. Recent juvenile surveys in the Santa Cruz Mountain stratum (south of San Francisco Bay) for the steelhead indicate they are present in all major watersheds from San Gregorio Creek south to Aptos Creek (B. Spence,

[1] Hatchery release and return data supplied by CDFG is preliminary and subject to change. These data may contain inaccuracies for which the Department of Fish and Game should not be held liable.

NMFS Southwest Fisheries Science Center, unpublished data). Other than Scott Creek, little is known about adult population sizes in this diversity stratum.

Discussion

The scarcity of information on steelhead abundance in this DPS makes it difficult to assess whether conditions have changed appreciably since the last review (Good et al. 2005). In the North Coastal, Interior, and Santa Cruz Mountain strata, most watersheds still appear to support some steelhead production, but there is great uncertainty about population abundance of almost all independent populations. The high number of hatchery fish in the Russian River suggests that risks associated with hatchery production are an issue. There is also uncertainty about the status of populations in the two San Francisco Bay strata. Many populations, particularly those where historical habitat is now inaccessible, are likely at high risk of extinction.

The original status review for this DPS concluded it was in danger of extinction (Busby et al. 1996), citing the likely extirpation of populations in Santa Cruz County and in tributaries to San Francisco and San Pablo Bays, as well as the apparent substantial declines in steelhead numbers in the Russian River. As previously mentioned, subsequent status reviews (NMFS 1997 and Good et al. 2005) concluded that the DPS was not presently endangered, but likely to become so in the foreseeable future. The general paucity of data was identified as a continuing source of uncertainty. Given this information Williams et al., 2011) concluded that the biological status of this DPS was unchanged from that reported by Good et al. (2005).

NC Steelhead DPS

Abundance and Trends

Bjorkstedt et al. (2005) concluded that the NC steelhead DPS historically comprised 42 independent populations (19 functionally independent and 23 potentially independent) populations of winter-run steelhead, and as many as 10 independent populations (all functionally independent) of summer-run steelhead. In addition, this DPS likely contained a minimum of 65 or more dependent populations of winter-run steelhead in smaller coastal watersheds, as well as small tributaries to the Eel River. Steelhead populations were assigned to five geographically based diversity strata: Northern Coastal, Lower Interior, North Mountain Interior, North-Centeral Coastal, and Central Coastal, with two Northern Coastal and North Mountain further subdivided into winter-run and summer-run life history types (Bjorkstedt et al. 2005; modified in Spence et al. 2008) (Table 5). For winter-run populations, adult spawner viability targets were based on intrinsic habitat potential modeling and adult spawner density estimates developed by Spence et al. (2008). Targets were not developed for summer-run populations because availability of over summering habitat for adults is more likely to limit abundance than either spawning or juvenile rearing habitat.

Spence et al. (2008) concluded that adult abundance information for steelhead in this DPS were insufficient to rigorously evaluate the viability of the 42 independent populations of winter-run steelhead using criteria developed by the TRT. Fish counts at Van Arsdale Fish Station in the Upper Eel River basin represent the longest time series data of abundance for adult steelhead in

this DPS. Fish are collected from three separate populations upstream: Bucknell Creek, Soda Creek located in the Lower Interior stratum, and the upper main stem Eel River located in the North Mountain Interior stratum. The TRT concluded that populations in Bucknell Creek and Soda Creek are at moderate to high risk of extinction based on low adult counts at Van Arsdale Fish Station and prevalence of hatchery fish (i.e., >90%) counted from 1997-2007. Bucknell Creek and Soda Creek were originally included as focus populations in Spence et al. 2008; however, NMFS removed these creeks from the list in the CIE draft Multi-species Recovery Plan because of natural barriers in both creeks that block fish passage. The Upper Eel River population was deemed to be at high risk of extinction due to the loss of the majority of historical habitat above Scott Dam and the high proportion of hatchery fish returning to Van Arsdale. Short time series data of adult population abundance from Pudding Creek, Noyo River, Caspar Creek, and Hare Creek on the Mendocino Coast suggest that all four populations could potentially be considered at moderate risk of extinction if population abundances remain relatively constant over time (Spence et al. 2008). All other winter-run populations were deemed data deficient.

Summer-run populations have been sampled more regularly as these adult fish can be quantified more easily than winter-run population during summer months because they can be counted in holding pools. The largest summer run population in the DPS spawns in the Middle Fork Eel River and has been surveyed annually since the 1960s. This population was deemed at moderate risk of extinction due to the fact that although population numbers continued to be slightly above low-risk thresholds (i.e., established by the TRT), there continued be a long-term declines in summer run populations. The TRT concluded that the Mad River summer-run population was likely to be at moderate risk of extinction. Two other summer-run populations, Redwood Creek and Mattole River, were deemed to be at high risk of extinction based on very low adult counts (Spence et al. 2008).

New Data and Updated Analyses

Population level abundance estimates for independent populations of NC steelhead are extremely limited, particularly for winter-run populations. Monitoring efforts have produced population abundance estimates for winter run populations in several streams and rivers along the Mendocino Coast (Pudding Creek, Noyo River, Caspar Creek, and Hare Creek); however, the available time series data are relatively short (7-9 years) and thus they provide little information to evaluate population trends. Risk metrics were computed for short time series, but are intended only to provide a general frame of reference and not a rigorous assessment of population status. Monitoring of winter-run steelhead populations have occurred in recent years in Prairie Creek, Freshwater Creek using weir counts, South Fork Noyo River, Little River (Mendocino Co.), and the Wheatfield Fork of the Gualala River. In all of these cases, spawner surveys cover only a portion of the total watershed and therefore constitute a partial population estimate for winter-run steelhead. Steelhead counts also continue to be made at Van Arsdale Fish station; however this count represents a composite of three independent populations. Summer-run populations have been monitored using dive counts in four watersheds including Redwood Creek, Mad River, Mattole River, and Middle Fork Eel River; Northern Coastal and North Mountain diversity strata, respectively. Only the Middle Fork Eel River counts are likely a reasonable estimate of population level abundance.

In the Northern Coastal stratum, population estimates have been generated for Prairie Creek (part of the Redwood Creek population) for the past five years. During this time the average estimate was 64 fish, however in years 2009 and 2010 average estimates were 12 and 4 fish, respectively. In Freshwater Creek (part of the Humboldt Bay population), population estimates over the last nine years averaged 212 fish (range 50-434), with a slight negative but non-significant (p = 0.602) trend driven by decreasing numbers over the last 5 years. Winter steelhead abundance data are not available for the Mad River basin except for counts of hatchery fish at the Mad River Hatchery. These counts indicate average returns of more than 2,300 fish annually since the 2000-2010 seasons. Release of juvenile steelhead from the hatchery during this period averaged over 226,000 fish (J. Urrutia, CDFG, Sacramento, unpublished data)[2]. Estimates of the fraction of hatchery fish on natural spawning grounds are not available, but the substantial hatchery production suggests artificial propagation could be a significant risk factor for the wild population in the Mad River.

There is very little data available for winter-run populations in the Lower Interior stratum, and in the North Mountain Interior diversity stratum. The only available data are from the Van Arsdale Fish Station counts which represent a composite of the Upper Eel River (North Mountain Interior), Bucknell Creek, and Soda Creek populations (Lower Interior). These counts are strongly influenced by hatchery production. Hatchery and wild fish have been reported separately since the 1996-1997 spawning season. Despite the fact that hatchery steelhead have been released only once (2004-2005) since the 1997-1998 season, hatchery fish have comprised approximately 81% of the fish returning to Van Arsdale since 1996 (NMFS, 2011). This reflects the extraordinarily large number of hatchery fish returning (as many as 7,300) relative to the number of wild fish, which has averaged about 250 fish returning fish per year. The trend in abundance of wild fish has been positive (p = 0.048) over the last 14 years. Because of the large hatchery influence, all three populations represented by these counts are likely at least at moderate risk of extinction. The Upper Eel population likely constitutes a high risk of extinction due to the loss of the majority of the historical stream habitat.

In the North Central Coastal stratum, population level estimates for four independent populations (Pudding Creek, Noyo River, Caspar Creek, and Hare Creek) all indicate non-significant negative trends. These population level estimates should be viewed with caution because the time series data are of short duration. Of these populations, the Noyo River population appears the largest, with an estimated average of 302 spawners (range 186-476). Longer time series data (11 yrs) are available for the South Fork Noyo River. Over the last seven years this population accounted for approximately 20-25% of the total Noyo River population. Pudding Creek averaged 133 spawners (range 10-265) over eight years; Caspar Creek 64 spawners (range 6-145) over 9 years; and Hare Creek 90 spawners (range 43-162) over five years. Though none of these time series meet the minimum length ($\geq$ 12 years) for applying the TRT's viability criteria, should current patterns continue the Pudding Creek and Noyo River populations would likely be considered at moderate risk of extinction. Caspar and Hare creek populations would possibly be considered at high risk of extinction based on the effective population size criterion. In the

[2] Hatchery release and return data supplied by CDFG is preliminary and subject to change. The data may contain inaccuracies for which the Department of Fish and Game should not be held liable.

Wheatfield Fork of the Gualala River (Central Coastal stratum), a monitoring effort is ongoing to determine fish abundance. Counts of adult steelhead have averaged 1,915 adults (range 369-5843); surveys over the last 8 years have shown no discernable trend in fish abundance (p = 0.999).

Summer diver surveys have been used to determine adult summer-run steelhead populations in four watersheds within the NC steelhead DPS. Three of the summer-run populations are located in the Northern Coastal Diversity stratum and one is in the North Mountain Interior stratum (Middle Fork Eel River). In Redwood Creek, dive surveys cover a reach of approximately 25.9 km and have been conducted annually since 1981. Mean fish counts have averaged 10 fish during the period of record (range 0-44), during which the trend in fish abundance was negative fish over time but the trend was not significant (p = 0.547). Overall, the recent 16-year trend has been positive (p = 0.029) however, the critically low fish abundance overshadows this recent trend. In the last two decades, dive counts of summer steelhead in different reaches of the Mad River have been conducted by three different entities: CDFG, USFS, and Green Diamond Resource Company. Fish counts provided by CDFG and USFS were discontinued in the early 2000s. Currently the Green Diamond counts, which ran from 1994 through 2005 and cover several reaches between the confluence of Deer Creek and Mad River Hatchery, are the most consistent among years. Counts averaged 252 fish (range 78-501) over the period of record, but should be viewed as minimum estimates, because all reaches were not surveyed during the period of 2001-2005. Because of the inconsistency in survey efforts, trend analyses were not conducted on these time series data.

The Middle Fork Eel River, which has been monitored since the mid-1960s, has the longest and most comprehensive fish abundance time series data for summer-run steelhead. Fish counts have averaged 780 fish over the period of record and 609 fish in the last 16 years. Both the short-term (16-year) and long-term (44-year) show negative trends over time but the trends are not significant (p = 0.507 and p = 0.424, respectively). Reports on the annual summer steelhead abundance surveys have been published by the Mattole Salmon Group on the Mattole River from 1996 to 2007; annual summer counts have been conducted the last four years since the release of the latest report. Because survey efforts vary among years, the measure of the number of fish per km provides the best index of abundance. The use of this index suggest (for the Mattole River) marginally significant negative trends in the number of adults (slope = -0.013; p = 0.072) and a positive trend for half-pounders (slope = 0.044; p = 0.093) over the period of record.

Discussion

The scarcity of steelhead abundance time series data at the population level continues to hinder assessment of the status of the NC steelhead DPS. Population level estimates of abundance are available for only 4 of the 42 independent populations of winter-run steelhead identified by the TRT. Similarly, population level estimates of fish abundance are available for only 1 of 10 summer-run steelhead populations in the DPS. All remaining time series data are partial population estimates, thus population estimates based on these data should be interpreted with caution.

With those caveats in mind, trend information from the available data sets show a number of different patterns. For example, slightly more populations show a decrease in population over time than an increase. Few of these trends are statistically significant, and in the last five years many populations show a decline in fish abundance. The trend results are not surprising, given the recent drought that affected all of coastal California from 2007 to 2009 and the unfavorable conditions in the marine environment. Where population level estimates of abundance are available, only the Middle Fork Eel River summer-run steelhead populations approach low-risk thresholds established by the TRT, failing to satisfy only the effective population size criterion. The remaining populations for which adult abundance has been estimated (i.e., those on the Mendocino Coast) appear to be at either moderate or high-risk of extinction.

Of continued concern is the depressed status of two of the remaining summer-run populations in Redwood Creek and Mattole River. Although surveys within these watersheds do not typically encompass all available summer habitats, the chronically low numbers observed during surveys in these rivers suggest that both populations are likely at high risk of extinction. In the Mad River, the high number of hatchery fish in the basin, coupled with the uncertainty regarding the relative abundance of hatchery and wild spawners is also of concern. For all remaining populations, there is little information from which to assess status. It is generally assumed that winter steelhead continue to inhabit most of the watersheds in which they historically occurred and thus all diversity strata within the DPS appear to be represented by extant populations. However given this information, there is still little basis for assessing whether conditions have improved or worsen over the past 5-8 years.

Busby et al. (1996) and Good et al. (2005) concluded that the NC steelhead DPS was not presently in danger of extinction, but was likely to become endangered in the foreseeable future. These reviews identified the following concerns: (1) low population abundance relative to historical estimates; (2) recent downward trends in most stocks for which data were available, and (3) the low abundance of summer run steelhead populations. They also cited continued habitat degradation, the increasing abundance of a nonnative predator (Sacramento pike minnow) in the Eel River, the influence of artificial propagation for certain wild populations and the lack of data for this DPS as concerns and sources of risk (Busby et al. 1996; Good et al. 2005). Based on a consideration of all new substantive information regarding the biological status of this DPS, Williams et al., (2011) concluded that its status was unchanged from that found by Good et al. (2005).

Table 5. North-Central California Coast Recovery Domain Multi-species diversity strata and focus populations for CCC steelhead and NC steelhead (NMFS, 2011). Diversity strata are underlined and in bold. Not all dependent and independent populations are listed in the table. For a complete list of all populations arranged by diversity strata see Spence et al (2008).

CCC Steelhead, DPS	**NC Steelhead, DPS (winter-run populations)**	**NC Steelhead, DPS (summer-run populations)**
Diversity Strata/Populations		
North Coastal	**Northern Coastal**	**Northern Coastal**

Austin Creek Salmon Creek Walker Creek Lagunitas Creek Green Valley Creek	Humboldt Bay Little River Mattole River Redwood Creek (lower) South Fork Eel River	Mad River (lower) Mattole River Redwood Creek (lower) South Fork Eel River
Interior Dry Creek Maacama Creek Mark West Creek Upper Russian River	**Lower Interior** Woodman Creek Chamise Creek Tomki Creek Outlet Creek	**North Mountain Interior** Mad River (upper) Redwood Creek (upper) Upper Mid-mainstem Van Duzen Creek
Santa Cruz Mountains Aptos Creek Pescadero Creek Pilarcitos Creek San Lorenzo Creek San Gregorio Creek Scott Creek Soquel Creek Waddell Creek	**North Mountain Interior** Larabee Creek Middle Fork Eel River North Fork Eel River Redwood Creek (upper) Van Duzen	
Coastal San Francisco Bay Corte Madera Creek Guadalupe River Miller Creek Novato Creek San Francisquito Creek	**North-Central Coastal** Big River Caspar Creek Noyo River Ten Mile River Usal Creek Wages Creek	
Interior San Francisco Bay Alameda Creek Coyote Creek Napa River Petaluma River San Leandro Creek San Lorenzo Creek	**Central Coastal** Garcia River Gualala River Navarro River	

2.3.2 Five-Factor Analysis (threats, conservation measures, and regulatory mechanisms)

Section 4(a)(1) of the ESA and the regulations in 50 CFR Part 424 set forth procedures for listing species. NMFS must determine, through the regulatory process, if a species is endangered or threatened based upon any one or a combination of the following factors: (1) the present or threatened destruction, modification, or curtailment of its habitat or range; (2) overutilization for commercial, recreational, scientific, or education purposes; (3) disease or predation; (4) inadequacy of existing regulatory mechanisms; or (5) other natural or human-made factors affecting its continued existence. New information relating to each of these five listing factors is

discussed below including information regarding important conservation efforts being made to protect the DPSs where appropriate.

2.3.2.1.1 Present or threatened destruction, modification or curtailment of its habitat or range

All pertinent Federal Register notices, including both proposed and final listing determinations for both DPSs were reviewed. Documented threats at the time of listing were only those specifically described in the listing determination notices for which the notice pertained, or those incorporated by reference. An additional assessment was conducted to define current status of threats identified at the time of listing through consultation with staff/personnel from NMFS, CDFG, and other entities. In 2008, NMFS catalogued all data to facilitate the tracking of threats identified at the time of listing; those threats that have changed since listing, and any newly identified threats. This information is documented in an internal draft Recovery Plan for the North Central California Coast Recovery Domain. Each table within the document records the date and page number of publication in the FR, and describes each as it was presented in the FR at the time of publication. New, and forecasted threats are compared against the listing factors and linked to associated strategies by threat category. This analysis allows NMFS to track during reclassification to a possible down-listed or delisted status, and provides a framework to assess and/or determine how the recovery program is more likely to ensure underlying causes of decline have been addressed or mitigated. The results from this document are listed below and demonstrate that overall there has been little to no change in threats to either DPS since they were first listed.

CCC steelhead DPS

At the time of listing the CCC steelhead DPS and the habitats within the range of the DPS were adversely affected by logging, road construction, urban development, mining activities, agriculture, ranching and recreation (NMFS 1996a; 62 FR 43937; 70 FR 834). These activities resulted in the loss, degradation, simplification, and fragmentation of steelhead habitat. A wide range of impacts resulted from these activities including: alteration of steam banks and channel morphology, alteration of ambient water temperatures, degradation of water quality, elimination of spawning and rearing habitat, elimination of spawning gravels and large woody debris (LWD), removal of riparian vegetation and increased stream sedimentation. The effects of periodic flood events exacerbate the adverse effects of these activities.

Water storage, withdrawal, conveyance, and diversions for agriculture, flood control, domestic, and hydropower purposes significantly reduced or eliminated historically accessible habitat. Two major habitat blockages are Coyote and Warm Springs Dams located in the Russian River Basin (NMFS, 1996a). Currently, the Pacific States Marine Fisheries Commission passage assessment data base provides information on 422 anthropogenic blockages mostly on small tributaries within the CCC steelhead DPS (all barriers are listed as total barriers). The majority of these blockages are road crossing and small dams. Many other smaller blockages likely exist within the CCC steelhead DPS (Titus et al. 2002). Direct and indirect effects caused by modification of natural flow regimes have had significant negative impacts on steelhead in this DPS (e.g., mortality of adults/juveniles, alterations of fish communities and impacts to migration, spawning, rearing and refugia).

Land use activities associated with logging, road construction, urban development, mining, agriculture, ranching, and recreation have resulted in the loss, degradation, simplification, and fragmentation of steelhead habitat in this DPS. These changes result in significant alterations to stream bank and channel morphology, stream temperature, water quality, sediment accumulation and large wood recruitment which significantly affect all life stages of steelhead. In most western States, 80% to 90% of historical riparian habitat has been eliminated and in California riparian wetland habitat has been reduced by over 90% (Dahl, 1991, 2011; Jensen et al., 1990; Barbour et al., 1991; as cited in NMFS, 1996a). Historical damage to fish habitat remains to be addressed and restoration activities will require decades of work; certain land use practices continue to pose risks to the survival of steelhead.

Urbanization has led to degraded steelhead habitat through stream channelization, floodplain drainage, and riparian damage (Botkin et al. 1995). The distribution of large floods over time reflects the precipitation and runoff region of the watershed, and large floods are natural and necessary for the drainage of the watershed and maintenance of the river channel. When watersheds are urbanized, problems may result simply because structures are placed in the path of natural processes, or because urbanization itself has induced changes in the hydrologic regime, which in turn impact structures. Point source (PS) and nonpoint source pollution (NPS) are ubiquitous in urbanized landscapes. Impervious surfaces (i.e. concrete) reduce water infiltration and increase runoff, thus creating greater flood hazard (Leopold, 1968). Flood control and land drainage schemes may increase the flood risk downstream by concentrating runoff. A flashy discharge pattern results in increased bank erosion with subsequent loss of riparian vegetation, undercut banks and stream channel widening. Sediments washed from the urban areas and deposited in river waters include trace metals such as copper, cadmium, zinc, and lead (CSLC, 1993). These, together with pesticides, herbicides, fertilizers, gasoline, and other petroleum products, contaminate drainage waters and destroy aquatic life necessary for steelhead survival. In 1991, The California State Water Resources Control Board reported that NPS pollution is the cause of 50 to 80 percent of impairment to water bodies in California.

In most western states, about 80 to 90 percent of the riparian habitat has been eliminated. While historical uses of riparian areas (e.g., fuel wood cutting, clearing for agricultural uses) have substantially decreased, urbanization still poses a serious threat to remaining riparian areas. Areas adjacent to rivers are desirable places to locate homes, businesses, and industry. Further, development within the flood plain results in vegetation removal, stream channelization, habitat instability, and point and nonpoint source pollution.

Since the DPS was listed, these factors have not significantly changed and the threats continue to persist. Land use activities associated with urban development, logging, road construction, mining, agriculture, ranching, and recreation, and their associated impacts continue to result in the loss, degradation, simplification, and fragmentation of steelhead habitat resulting in population declines. Water storage, withdrawal, conveyance, and diversion activities continue to reduce or eliminate historically accessible habitat, and also continues to result in direct mortality of adult and juvenile steelhead. Many significant habitat blockages exist within the DPS including, Coyote and Warm Springs Dams located in the Russian River Basin. Large scale tidal and wetland restoration projects have begun to improve conditions in the lower Napa River

watershed, and in southern San Francisco Bay, and the restored habitats will provide improved water quality, refugia from high flows, and feeding opportunities for out-migrating smolts.

Conservation Efforts

NMFS reviewed conservation efforts aimed reducing the destruction, modification or curtailment of steelhead habitat or range within this DPS. Substantive efforts have been implemented including those by Federal, State and local entities. For example, in 2008 NMFS completed the Russian River Biological Opinion which addressed water operations managed by the U.S. Army Corps of Engineers (Corps) and the Sonoma County Water Agency (SCWA). The Reasonable and Prudent Alternative (RPA) included in the biological opinion focused on addressing three areas impacted by SCWA and the Corps water operations within the Russian River basin: (1) habitat degradation within the Russian River estuary, (2) Dry Creek, and (3) the main stem Russian River. The actions required in the RPA are expected to substantially improve habitat conditions in the basin.

The Fish Friendly Farming program is a conservation program led and organized by a non-government organization. This is a cooperative program with private landowners for implementation of environmental improvements in vineyard systems. The program is currently operating in Sonoma, Napa, Solano and Mendocino counties and is targeted at improving conditions for anadromous salmonids, including steelhead. NMFS has provided funding for both operational costs (through contracts) and project implementation (through competitive grant processes) since the program inception that has resulted in leveraged funding. Landowners enroll their property into the programs, attend a series of educational workshops on environmentally-friendly land management practices, and complete a detailed farm conservation plan for their property which describes best management practices and specific conservation projects. Best management practices may include road repair and erosion management, use of cover crops, proper water diversion pump screening, planning considerations for vineyard expansions or replants, and low impact pesticide selection and application recommendations. Projects encouraged by the program include creek and river corridor re-vegetation and restoration, erosion repairs on sites such as gullies and old roads, eradication of invasive, non-native plants, fish passage barrier removal or modification projects.

Listed salmonids in the San Francisco Bay Estuary, including steelhead, would benefit from improved habitat composition and structure that would support improved food (prey) resources for both adults and juveniles, and shelter for juveniles. Practices to improve habitat conditions include, but are not limited to preservation of existing tidal and subtidal habitats, and restoration of habitats that have been degraded by past development and associated land uses. Several relevant efforts have been made to identify and prioritize these efforts, including the Goals Project (1999), the Subtidal Goals Project (CSCC, 2010), and the San Francisco Estuary Watershed Evaluation (Becker et al. 2007). Preservation and restoration efforts should proceed opportunistically, and should consider any unidentified opportunities in the San Francisco Bay that have potential value to the recovery of listed salmonids including steelhead.

In an effort to reduce serious impacts to streams and rivers, the State of California imposed a moratorium in 2006 on suction dredge mining permits. In 2011, the State of California extended

a ban on harmful suction dredge mining that would protect water quality, wildlife and cultural resources. The bill (A.B.120) continues the current ban on suction dredge mining over the next five years (2016) or until the state adopts new rules that fully mitigate all significant impacts caused by mining. The CDFG issued proposed regulations for suction dredge mining in the spring of 2011. In the interim, suction dredging no longer affects steelhead and their habitat. In spite of these and many other examples of conservation efforts aimed at reducing the destruction, modification or curtailment of steelhead habitat or range, these conservation efforts have not substantially reduced threats to the CCC steelhead DPS from this factor since the last review..

NC steelhead DPS

Land use activities associated with logging, road construction, urban development, gravel mining, agriculture, ranching, and recreation have resulted in the loss, degradation, simplification, and fragmentation of habitat for steelhead in this DPS which have led to population declines. Impacts associated with these activities include: alteration of stream bank and channel morphology; alteration of ambient stream water temperatures; degradation of water quality; elimination of spawning and rearing habitats; fragmentation of available habitats; elimination of downstream recruitment of spawning gravels and large woody debris; removal of riparian vegetation resulting in increased stream bank erosion; and increased sedimentation input into spawning and rearing areas (NMFS, 1996a). Land use practices can exacerbate the impact of flooding, and can cause substantial degradation to steelhead habitat (Busby et al. 1996).

Mathews Dam on the Mad River was identified as a substantial habitat blockage at the time the DPS was first listed (McEwan & Jackson 1996), but the dam blocks only 1.5 miles of marginal historical habitat which is naturally intermittent and dry during the summer/fall months. The flows coming from Mathews Dam have improved in-river flows for summer steelhead and juvenile steelhead rearing year-round. Many of the physical effects to habitat normally associated with dams are less severe with this blockage than with other dams[3].

Alteration of the natural hydrology through storage, withdrawal, conveyance, and water diversions for agriculture, flood control, domestic, and hydropower purposes have reduced or eliminated historically accessible habitat for steelhead. The Scott Dam on the Eel River has eliminated access to historical spawning and rearing habitat and has altered the natural flow regime within the basin (NMFS, 1996a). Modification of natural flow regimes has increased water temperatures, changed fish community structures, and depleted flows. A reduction in flow volume affects fish migration, spawning, and rearing, and reduces the flushing of sediments from spawning gravels, recruitment of gravel and transport of large woody debris (NMFS, 1996a).

As stated in NMFS' 2007 Recovery Outline for this DPS, riparian wetland habitat in California has been reduced by over 90% (Dahl 1991; Jensen et al., 1990; Barbour et al., 1991; as cited in NMFS, 1996a). The condition of the remaining riparian, wetland, and estuarine habitats for this DPS is largely degraded and at continued risk of loss or further degradation. The destruction or modification of riparian, wetland, and estuarine areas has resulted in the loss of important rearing and migration fish habitats (Dahl, 2011).

[3] Personal communication from G. Bryant, NMFS, Protected Resources Division, 1655 Heindon Road, Arcata, CA 95521.

Since the original listing of this DPS and the last status review (Good et al. 2005), in-stream gravel mining practices have improved in Northern California. Mining operations are permitted by the Corps and the permits in place contain numerous impact minimization measures aimed at reducing the effects of gravel extraction on steelhead and their habitat. However, even with minimization measures, gravel extraction reduces overall habitat complexity and reduces the quality and quantity of available pool habitat (Simon and Hupp, 1992). Given the sensitivity of channels to disturbance (i.e., current lack of floodplain and channel structure; low levels of in-stream wood), and the use of gravel extraction reaches by steelhead summer for rearing, gravel extraction is a threat to rearing juveniles and a moderate threat to adults that require resting habitat in pools during upstream migration. In recent years, NMFS has worked with the Corps and others, pursuant to section 7 of the ESA, to minimize the effects of several gravel mining operations in Humboldt County, and the measures included in the resulting biological opinions have provided increased protection for steelhead and their habitat. In 2004, NMFS developed sediment removal guidelines specific to the SWR to reduce the impacts of gravel mining to salmonids habitat (NMFS, 2004). Beginning in 2009, the mining intensity of most gravel mining operations within the DPS will be correlated with annual water yields and annual estimates of sediment recruitment (NMFS, 2009).

Since this DPS was listed, the State of California implemented new regulations including special closed areas, closed seasons, and restrictions on gravel mining methods and operations to minimize and prevent disturbance of aquatic habitat (Cal. Code Regs., tit. 14, Sections 228 and 228.5). These new regulations are expected to protect habitat for steelhead and other salmonids, but careful monitoring of mining activity is necessary to ensure compliance.

Conservation Efforts

NMFS reviewed conservation efforts aimed at reducing the destruction, modification or curtailment of steelhead habitat in this DPS since the last review. Important efforts have been implemented by Federal, State and local entities that have improved habitat conditions in some areas for steelhead.

The new draft mining regulations open mining to many rivers and streams that had been closed under the previous regulatory framework thereby threatening critical habitat for threatened and endangered salmonids. In 2004, NMFS began implementing procedures for reviewing, approving, and monitoring gravel mining activities in Humboldt, substantially improving protections for anadromous salmonids and their habitat. The process is used to permit in-stream gravel mining in Humboldt County as well as batched individual permits for gravel mining on the Mad River. Since 2004, the methods used to extract gravel from all streams in Humboldt County have been modified so as to better protect steelhead and its habitat. These efforts have improved salmonid habitat by decreasing the risk of stream braiding, increasing overall gravel bar heights, and improving fish passage conditions. Overall, we expect these efforts these management efforts to maintain, or gradually improve, spawning, rearing, and migration habitat for salmonids, including steelhead NMFS has also provided extensive technical assistance to both Mendocino and Sonoma counties (i.e., sediment removal guidelines) to assist them in reducing the impacts of gravel mining on salmonids. Despite these and many other examples of

conservation efforts aimed at reducing the destruction, modification or curtailment of habitat or range for steelhead in this DPS, these efforts collectively have not significantly reduced the threats associated with this factor since the species was last reviewed.

2.3.2.1.2 Overutilization for commercial, recreational, scientific, or educational purposes

CCC steelhead DPS

Ocean harvest of steelhead is extremely rare and is an insignificant source of mortality for this DPS. High seas drift net fishing has been implicated as a past cause of decline for west coast steelhead, but cannot solely account for the large population declines that have occurred over past decades (NMFS, 1996a).

Recreational fishing for steelhead and other anadromous species occurs in many west coast streams including those in this DPS. Steelhead fisheries throughout California are selective, however, and only visibly marked (adipose fin clipped) hatchery-origin fish may be harvested. Mortality rates for naturally spawned fish caught and released in these fisheries are presumed to be low, but there is little to no data to actually estimate these impacts. Fishing effort estimates based on angler self-report cards are available for 1993–2005 which suggest that angler effort declined in this DPS from 2000-2005. More recent data on fishing effort is unavailable, but there is little reason to believe fishing effort has changed substantially. Periods of drought or low flow, however, can reduce habitat availability and concentrate fish thereby resulting in increased impacts even with the same fishing effort. Drought has been a problem over the past several years and so it is possible that impacts from recreational angling could be greater than expected in localized areas. Poaching is considered a serious problem on several coastal rivers south of San Francisco Bay (NMFS, 1996a) and there is little reason to believe such threats have declined. Overall, the available information suggests that impacts to steelhead from recreational angling are low and not appreciably changed since the last review (Good et al. 2005).

At the time this DPS was listed, collection of fish for scientific research and education programs was thought to have little or no impact on populations in this DPS (NMFS, 1996a). Take of fish for such purposes is carefully controlled through the issuance and conditioning of scientific collection permits by CDFG and NMFS. The majority of permits are issued to environmental consultants, federal resource agencies, educational organizations and academic institutions. Potential unintentional mortality of juveniles associated with scientific collection is thought to range from 1% to 3% of the total number of juveniles captured; however these percentages are most likely overstated. Impacts to steelhead associated with scientific collections in this DPS are small and we believe they are unchanged since the last status review (Good et al. 2005).

Conservation Efforts

NMFS reviewed conservation efforts aimed at reducing overutilization of steelhead in this DPS since the last status review. Both freshwater and ocean harvest impacts have remained low as a result of ongoing management efforts. The State of California continues to prohibit the retention of natural origin steelhead and only allow the harvest of marked hatchery fish. However, most if

not all hatchery propagated steelhead in this DPS are managed for conservation/recovery purposes rather than to supplement recreational angling which should minimize impacts from incidental bycatch. During 2008 and 2009, the closure of nearly all salmon fisheries south of Cape Falcon, Oregon eliminated or severely curtailed impacts to steelhead in the ocean. Overall, ongoing conservation efforts serve to reduce, but not fully eliminate, impacts of fishing and specimen collection for scientific research on steelhead in this DPS.

NC steelhead DPS

As with the CCC steelhead DPS, ocean harvest is an insignificant source of mortality for this DPS. Recreational steelhead fishing is popular within this DPS and on the Mad River there is a bag limit of two hatchery steelhead. In those streams where only catch and release fishing is allowed, all wild steelhead must be released without further harm. There are also significant restrictions on gear used for angling. The impact of recreational angling is thought to be low for steelhead in this DPS; however, the actual level of impact cannot be estimated with existing data. Poaching of summer-run fish is considered a problem in watersheds in the northern range of the DPS (NMFS, 1996a). During periods of decreased habitat availability (drought or low flow conditions), recreational fisheries have a greater impact on wild steelhead and since the last status review there have been several years of drought which may have resulted in higher impacts in some localized areas.

Since the original listing in 2000 and it is likely that the impacts of recreational angling on steelhead have been relatively low because of the statewide prohibition on retention of natural origin fish that was implemented in 1998 and restrictions on gear use. As with steelhead in other coastal DPSs, fishing effort estimates based on angler self-report cards from 1993 to 2005 suggest that fishing effort has declined markedly since 2000. Although fishing effort estimates for more recent years are not available, there is little reason to believe that recreational fishing effort or the impact to steelhead in this DPS has changed substantially since the last status review (Good et al. 2005).

Conservation Efforts

NMFS reviewed conservation efforts aimed at reducing the overutilization of steelhead in this DPS for commercial, recreational, scientific, or educational purposes, including those identified in previous listing determinations and any efforts implemented since the last review (71 FR 834). Significant conservation efforts were implemented in the late 1990s for steelhead in this DPS including the required marking of all hatchery origin steelhead, a prohibition on the retention of natural origin steelhead, various area and seasonal closures, and specific fishing gear restictions. These efforts were aimed at reducing impacts on both juvenile and adult natural origin steelhead in this DPS. In addition, CDFG initiated its Steelhead Trout Catch Report-Restoration Card program which, in addition to generating revenue for stock enhancement and habitat restoration activities, requires anglers to record information on their fishing activities and harvest of anadromous fish including steelhead. The Report-Restoration Card allows CDFG to identify habitat restoration, conservation, and fishing regulation that are needed throughout the DPS (CDFG, 2007). These conservation efforts have continued since the last review was conducted in 2005 and provide substantial protection for steelhead in this DPS.

2.3.2.3 Disease or predation

CCC steelhead DPS

Infectious disease can influence adult and juvenile steelhead survival. Fish are exposed to numerous bacterial, protozoan, viral, and parasitic organisms in spawning and rearing areas, hatcheries, migratory routes, and the marine environment. Specific diseases present and known to affect steelhead include bacterial kidney disease (also known as BKD), ceratomyxosis, columnaris, furunculosis, infectious hematopoietic necrosis, redmouth and black spot disease, erythrocytic inclusion body syndrome, and whirling disease. Studies have shown native fish tend to be less susceptible to such pathogens than hatchery-reared fish (Buchanan et al. 1983; Sanders et al.1992). In general, very little current or historical information exists to quantify changes in infection levels and mortality rates attributable to these diseases. Steelhead co-evolved with specific communities of these organisms, but the widespread use of artificial propagation has introduced exotic organisms not historically present in a most watersheds. Habitat conditions such as low water flows, high temperatures, and artificial passage routes through man-made barriers can exacerbate susceptibility to infectious diseases. These potential threats from disease were identified at the time of original listing and reaffimed in the last status review; however, there is little or no evidence indicating that threats to this DPS from disease have appreciably changed since the last status review.

In general, predation is not considered to be a significant factor in the decline of west coast steelhead populations including populations in this DPS (71 FR 834). Where predation may be problematic are those situations where prey are absent and/or physical conditions (i.e. habitat modification and/or a decrease in water quantify or quality) lead to concentrations of adults and juveniles that make them more susceptible to predation (NMFS 1996a and 71 FR 834). Marine predation is a concern in some areas, given the dwindling steelhead run-size in recent years (71 FR 834). Predation by marine mammals (harbor seals and sea lions) coincidental with salmonids migrations may, in some cases, kill a significant fraction of a run and local depletion might occur (NMFS 1997; Quinn, 2005; Stansell et al., 2010). Potential threats from predation were identified at the time of original listing and reaffirmed in the latest status review. There is little or no evidence indicating that threats to this DPS from predation have appreciably changed since the last status review.

NC steelhead DPS

As noted above, a number of viral and bacterial infections have been reported for steelhead. In general, there exists little historical information to quantify changes in infection levels and mortality rates attributable to these diseases. However, studies have shown that naturally spawned fish tend to be less susceptible to pathogens than hatchery-reared fish (Buchanan et al. 1983; Sanders et al. 1992). Steelhead co-evolved with specific communities of these organisms, but the widespread use of artificial propagation has introduced exotic organisms not historically present in a many watersheds. Habitat conditions such as low water flows, high temperatures, and artificial passage routes through man-made barriers can exacerbate susceptibility to infectious diseases (71 FR 834 at 856).

Introductions of non-native species and habitat modifications have resulted in increased predator populations and predator success rates in this DPS. Introduced Sacramento pikeminnow, a serious predator limiting steelhead recovery (Yoshiyma and Moyle, 2010) whose populations have flourished with warmer water conditions, consume juvenile salmonids throughout the Eel River Basin. No significant eradication efforts have been conducted since the last status review. Data collected in the upper Eel River by PG&E (2010) indicate that pikeminnow populations have decreased from peak numbers in the 1980's and 1990s, but monitoring efforts since 2005 show their abundance has been variable. It is also possible that increased flows from the Potter Valley Project that began in 2005 (Jahn, 2010, pers. comm.) have contributed to the decline in pikeminnow abundance. Overall, however, the predation threat to steelhead from the Sacramento pikeminnow is thought to be unchanged since the last status review in 2005 (Good et al. 2005).

Although, fishes form the principle food source of many marine mammals, steelhead appear to be a minor component of their diet (Jameson and Kenyon, 1977; Roffe and Mate, 1984). However, in Oregon and California, predation by pinnipeds (harbor seals and California sea lions in particular) is of concern due to the increased numbers along the Pacific Coast combined with the dwindling run sizes of salmon and steelhead. The West Coast Pinniped Program was established in 1997 by NMFS and the Pacific States Marine Fisheries Commission (PSMFC) to investigate the impacts of expanding pinniped populations on salmonids (especially ESA-listed salmon) and other fishery resources. Investigations of pinniped predation on salmonids were conducted in West Coast Rivers and estuaries including rivers draining into Hood Canal, Ozette River, Columbia River, Alsea River, Rogue River, Klamath River, Mad River, San Lorenzo River; as well as at Bonneville Dam, Willamette Falls, in the San Juan Islands, at Año Nuevo Island, and in Monterey Bay. A report on these investigations found that: (1) California sea lions have reached optimum sustainable population levels, but that population levels varied between 2006-2008, (2) California sea lions interact with hook-and line fisheries for salmon and other important fisheries, (3) non-lethal deterrence measures have limited effectiveness on pinnipeds, and (4) although significant progress has been made in developing and applying methodologies to determine the impacts of pinniped predation on salmonids; further research is need to better estimate pinnipeds impacts on ESA-listed salmonids (Scordino, 2010). Within the range of this DPS, Hanson (1993) reported minimal predation on anadromous salmonids by harbor seals and California sea lions at the mouth of the Russian River, and there is concern that sea lions feed on salmon and steelhead in Humboldt Bay and the Mad River.

Steelhead have coexisted historically with pinnipeds throughout their range and, while predation could potentially impede recovery with current populations being a low levels of abundance, it is unlikely predation was a factor contributing to the decline of steelhead populations in the first place or that this factor contributed to the listing of this or any other DPS. Nevertheless, marine predation is a concern in some areas given declining steelhead runs in recent years (71 FR 834 at 857), particularly when other prey are absent and/or physical habitat conditions lead to the concentrations of juvenile and adult fish. Predation by marine mammals that coincides with salmon or steelhead migrations may, in some cases, kill a significant fraction of a run and local depletion could potentially occur (NMFS, 1997; Quinn, 2005; Stansell et al. 2010). Although there continues to be concern about predation from marine mammals and other sources, there is

no information demonstrating that predation is a significant threat to this DPS or that the risk of predation has increased since the last status review in 2005.

Conservation Efforts

Actions aimed at restoring and enhancing freshwater and estuarine habitats and reducing impacats from water withdrawals (see section 2.3.2.1) are expected to help ameliorate conditions conducive to disease organisms and non-native predators that could adversely impact steelhead in both the DPSs. In particular, recent changes to water operations in the Eel River are expected to reduce pikeminnow predation on salmon and steelhead over time.

2.3.2.4 Inadequacy of existing regulatory mechanisms

CCC steelhead DPS

NMFS reviewed a wide range of Federal, State, local and other regulatory mechanisms and protective efforts for the CCC steelhead DPS based on past listing determinations and other sources. The following sections provide an overview of this review.

Federal Regulatory/Conservation Efforts

Pursuant to section 7 of the ESA, NMFS issued a jeopardy biological opinion in 2008 which addressed the impacts to steelhead and its habitat from water operations managed by the Corps and by the Sonoma County Water Agency (SCWA) in the Russian River. This biological opinion contained a reasonable and prudent alternative (RPA) that addressed three areas impacted by SCWA and the Corps water operations within the Russian River basin, including the Russian River estuary, Dry Creek, and the mainstem Russian River. The actions required by the RPA are expected to substantially improve habitat conditions for steelhead using these areas over time.

The Pacific Coastal Salmon Recovery Fund (PCSRF) was established by Congress in FY 2000 to protect, restore, and conserve Pacific salmon and steelhead populations and their habitats on the west coast. Under the PCSRF, NMFS has provided annual funding to the State of California and native American Indian tribes to implement habitat restoration and other salmon recovery efforts. Under this program a large number of restoration and recovery projects have been funded and implemented to improve habitat conditions in the watersheds that support this DPS.

Conservation and advance mitigation planning efforts are being considered or proposed by many agencies and project proponents. An increasing number of conservation banks targeting NMFS species and their habitats are being proposed by bank sponsors. The SWR is currently engaged in a number of conservation banking activities which include the operation of established bank sites, developing new banks, developing regional and state-wide mitigation initiatives with state agencies, and interagency efforts to improve and maintain consistent coordination. In 2011, the SWR issued policy guidance for the review, establishment, use, and operations of conservation banks and in-lieu fee mitigation programs within the Southwest Region. A summary of ongoing and potential banking efforts within the range of this DPS are described below.

- Phase 1 of the East Austin Creek Conservation Bank is a 124 acre parcel of land located on Austin Creek, a tributary to the Russian River. A private landowner and NMFS signed an agreement on the bank in 2010. The bank agreement is on file at the SWR's North Central California Coast Office. The bank targets Central California Coast coho and steelhead and has credits for riparian and upland habitats that maintain natural stream processes. The service area is a 2-tiered system. The primary service area includes Marin and Sonoma Counties, and may be utilized for mitigation and conservation. The secondary area includes the entire Central California Coast coho and steelhead ESU/DPSs, and may be used for conservation purposes. Phase 2 of the bank proposes future addition of an adjacent 320 acre parcel.

- The Statewide Advance Mitigation Initiative (SAMI) Memorandum of Understanding (MOU) establishes a mutual framework for developing a coordinated advanced mitigation plan for projects proposed by the California Department of Transportation (Caltrans). The MOU was signed in 2011 by Caltrans, CDFG, Corps, the Environmental Protection Agency (EPA), the US Fish and Wildlife Service (USFWS), and NMFS. The SAMI may include conservation and mitigation banks, in-lieu fee (ILF) programs, or other appropriate mitigation or conservation measures. The MOU addresses unavoidable impacts to aquatic ecosystems resulting from transportation projects and specifically requires Caltrans to first avoid and minimize impacts.

- The Regional Advanced Mitigation Project (RAMP) MOU was signed by in 2009 by Caltrans, the Business Transportation and Housing Agency, the Wildlife Conservation Board, EPA, USACE and the California Department of Water Resources (DWR) to improve project mitigation and streamline the mitigation process for transportation and flood control infrastructure projects. A copy of the MOU is on file at the NMFS SWRO. The RAMP MOU establishes a working group that will develop a regional plan to develop, implement and institutionalize strategies that encourage the use of advanced regional mitigation planning and projects in the planning, design, and implementation of transportation and flood infrastructure projects. The workgroup is pursuing a pilot project to apply these principles and strategies.

- Pinole Valley Mitigation bank, a large (approximately 3,681 acres) proposal from the East Bay Municipal Utilities District that will target providing mitigation benefits for this DPS. This watershed is a high priority for steelhead recovery in this DPS.

- In the San Francisco Bay, San Antonio Creek conservation bank has been proposed by a group of private landowners to protect habitat for this DPS.

Federal Water Quality Management

At the time this DPS was listed in 1997 listing, NMFS indicated it was concerned about the development and implementation of TMDLs for many Clean Water Act (CWA) 303(d) listed water bodies in Califonria (62 FR 43937). The State's Regional Water Quality Control Boards and the EPA administer the CWA and are required to develop TMDLs for water bodies that are placed on the 303(d) list as being impaired due to sediment, nutrients, pesticides, etc. Since the original listing and the last status review, a number of watersheds within this DPS have established TMDLs to reduce pollutant loads to impaired water bodies. NMFS' expects these TMDLs will eventually improve steelhead habitat in this DPS in the long-term, but they are difficult to implement in a timely manner and it is uncertain how effective they will be and how long it will take to demonstrate substantial benefits.

The EPA has consulted under section 7 with NMFS concerning the re-registration of 37 pesticide active ingredients. These consultations in 2008 and 2009 concluded that the current use of organophosphates (e.g. chlorpyrifos, diazinon, and malathion), carbamates (carbofuran, and carbaryl), and methomyl are likely to jeopardize many of the listed salmon and steelhead on the west coast, including in some cases this DPS. Long term efforts to better control the use of these chemicals is expected to improve water quality and provide improved protection for a wide range of listed salmonids including steelhead in this DPS, but such benefits are likely to require a long period of time to be realized.

Non-Federal Efforts

The state of California has developed and implemented, or will implement, a number of programs that are expected to directly and indirectly reduce threats to steelhead in this DPS. For example, CDFG has taken the lead in developing a statewide coastal salmonid monitoring program that is essential for assessing the biological status of listed salmon and steelhead populations and species in California. This monitoring plan was completed in 2011 and once implemented is expected to substantially improve salmon and steelhead population level estimates. Funding for the program is uncertain and and therefore it is uncertain if and when the program will be implemented. CDFG has also developed a Salmon and Steelhead Stock Management Policy to address issues associated with introduction of non-native steelhead via hatcheries, but to date it has not been implemented

CDFG, NMFS, and the Alameda Creek Fisheries Restoration Workgroup are working to re-establish steelhead in upper Alameda Creek on the eastern side of San Francisco Bay. In addition, the San Francisco Public Utilities Commission (SFPUC) is developing that Alameda Watershed HCP that is intended to accomplish the following objectives: (1) avoid, minimize, and mitigate the potential adverse effects to threatened and endangered species resulting from SFPUC activities; (1) accommodate current and future operations and maintenance activities in the Alameda watershed; and (3) provide the basis for take authorization pursuant to ESA and CESA. Once implemented, this HCP is expected to improve steelhead habitat in the watershed.

The Resource Conservation Districts (RCDs) operating in California's coastal watersheds have developed programs that allow the agricultural community to voluntarily implement

management practices that will reduce impacts to ESA listed salmonids and their habitat. Under these programs, the RCDs can assist landowners in developing and implementing best management practices that are protective of salmon and steelhead. As an example, the Sotoyome RCD has developed a voluntary certification program (called Fish Friendly Farming) for grape growers in Sonoma and Mendocino Counties who implement land management practices that decrease soil erosion and sediment delivery to streams. Such programs have the potential to address a wide range of impacts that adversely affect salmon and steelhead habitat, but more work is needed to expand this effort particularly with regard to water use and diversions.

FishNet 4C is a multi-county group that coordinates county efforts such as road maintenance, fish barrier assessment and removal, riparian and grading ordinances, erosion control, implementation of bioengineering projects and the development of guidelines for public works departments that enhance or protect salmonid habitat. The FishNet 4C program is a county-based, regional salmonid protection and restoration program, created under a Memorandum of Agreement between the six central California coastal counties of Mendocino, Sonoma, Marin, San Mateo, Santa Cruz and Monterey. Four of these counties, with the exception of Mendocino and Monterey, lie within the geographic range of the Central California Coast steelhead DPS.

State Water Management

The State Water Resources Control Board (SWRCB) Division of Water Rights administers a water rights permitting system which controls utilization of waters for beneficial uses throughout the State. This system, while it contains provisions (including public trust provisions) for the protection of in-stream aquatic resources, does not provide an explicit regulatory mechanism to implement DFG Code Section 5937 requirements to protect anadromous fish populations such as steelhead steelhead below impoundments. Additionally, the SWRCB generally lacks the oversight and regulatory authority over groundwater development comparable to surface water developments for out-of-stream beneficial uses. The North Coast Regional Water Quality Control Board (NCRWQB) recently updated its North Coast Basin Plan to establish water quality standards for all of the northern California rivers and streams. These plans incorporated newly developed TMDL standards which were developed for those water bodies listed as impaired under section 303(d) of the CWA. The Comprehensive Conservation and Management Plan for the San Francisco Bay-Delta Estuary was designed to help restore and maintain the estuary's water quality and natural resources. The plan was jointly sponsored by the EPA and the State of California. Many of the recommended actions stated in the plan could improve rearing and migratory habitat for steelhead in this DPS.

The Santa Clara Valley Water District initiated the Fisheries Aquatic Habitat Collaborative Effort which addresses water releases from dams on Coyote Creek, the Guadalupe River and Stevens Creek in Santa Clara County. This program is among the most comprehensive, well-funded, long-term protective efforts to provide suitable flows for salmonids, including steelhead, in California.

In 2011, the San Francisco Estuary Partnership released the State of the San Francisco Bay report, which provides a detailed summary of the Bay's health, by reporting on five different attributes: water quality and quantity, habitats, ecological processes, and living resources

(Summary of Bay Health, 2011, page v). In summary, the report indicates that the Bay's water quality has improved in the last 40 years, but the rate of improvement has slowed. Mercury, exotic species, toxic sediments and trash are still problems that need to be resolved in the Bay. Many of the potentially harmful chemicals have yet to be assessed. Freshwater inflows (i.e., the amount and variability) have been reduced, resulting in chronic drought conditions in the Estuary. Most importantly, since the 1980's, estuarine open water habitat has deteriorated and fish abundance and diversity are declining in all regions of the Bay except for the Golden Gate; with the poorest fish community condition in the Suisun Bay. In contrast, the Bay is less polluted than in past decades do to regulations of PCB's and DDT's, sewage treatment and solid waste management. Periodic health assessments like those provided by the San Francisco Estuary Partnership are critical to recovering the health of ESA-listed species.

Frost Protection Regulations

In 1972, the SWRCB determined frost protection irrigation was an unreasonable use of water in the Napa River and in 1977 the water masters system for the Napa River was codified. In 1997, a SWRCB Staff Report identified frost protection impacts to salmon and (Chinook and coho salmon) and steelhead in the Russian River and determined that: (1) frost protection is a waste and unreasonable use of water and (2) alternative methods of frost protection such as wind machines were a reasonable alternative. In 2008, drought and frost events led to fish kills which triggered the NMFS'OAA Office of Law Enforcement (OLE) open an investigation and form the Frost Protection Task Force. In early 2009, NMFS Habitat Conservation Division (HCD) requested that the SWRCB take action to address concerns that diversions for frost protection of crops in the Russian River basin that cause mortality of listed salmonids. NMFS recommended the SWRCB exercise their authorities to regulate water use to protect salmonids throughout their range from any harmful use. In late 2010, the SWRCB announced it would develop regulations to ensure that: (1) the instantaneous cumulative diversion rate would not result in a reduction in stream stage that is harmful to salmonids, and (2) there would be a monitoring and reporting for diversions. On Sept 16', 2011, the SWRCB adopted the Russian River Frost Protection Regulations that have not yet been implemented. In addition, NMFS has protested permitting of certain new water rights, and has urged the SWRCB to address unpermitted diversions in the basin as well as recommended no diversion from surface and hydrologically connected sources for forest protection.

The Sotoyome RCD developed a voluntary certification program (Fish Friendly Farming) for grape growers in Sonoma and Mendocino Counties who implement land management practices that decrease soil erosion and sediment delivery to streams. In 2011, the District also released the Vineyard Frost Protection: A Guide for Northern Coastal California. This set of guidelines summarizes frost protection methods specific to Northern Coastal California vineyards. The guideline includes a summary of the different types of frost, descriptions of frost protection methods, examples of equipment manufacturers and a review of management tools to minimize impacts to water quality.

Overall, existing regulatory mechanisms, primarily those addressing land and water use, continue to be inadequate. Although some improvements have occurred since the last status review, taken

collectively the existing regulatory mechanisms contribute along with other factors to the threatened status of this DPS and the degradation of its habitat.

NC Steelhead DPS

Inadequate regulatory mechanisms have contributed substantially to the decline of the NC steelhead DPS and to the ongoing the DPS faces threats from many activities. In developing the 4(d) rule for this DPS (67 FR 1116), NMFS noted several Federal, State, and local regulatory programs that have been implemented to reduce threats to this and other species. Although many regulatory mechanisms and conservation efforts were in place at the time this DPS was listed, NMFS concluded that they collectively did not provide for the attainment of properly functioning habitat conditions that would protect and conserve the species.

Federal Efforts

NMFS has conducted ESA section 7 consultations with over 20 Federal action agencies that authorize, fund, or carry out projects in the range of this DPS. In addition, NMFS has provided technical assistance to a wide range of Federal, State, and local agencies, and to private landowners for projects occurring throughout the range of the DPS. A wide variety of projects have been evaluated in carrying out these efforts including: irrigation and water diversion, timber harvest, watershed restoration, fish passage, gravel mining, grazing, and transportation projects. Section 7 consultations and technical assistance have improved project designs and avoided or minimized adverse impacts to steelhead and their habitats throughout the range of the DPS.

To date, only one draft Hatchery and Genetic Management Plans (HGMP) has been developed that addressed hatchery production of steelhead in this DPS. The draft Mad River hatchery HGMP was prepared by CDFG in 2006, but has not yet been finalized. The HGMP is intended to promote the integration of wild steelhead into the hatchery broodstock to preserve genotypes, as well as to minimize inbreeding and outbreeding. The conservation actions required by the HGMP once finalized are expected to substantially improve the viability and abundance of natural steelhead populations overtime in the Mad River and reduce the risk of hatchery production.

In 2011, the Coastal Salmonid Monitoring Plan (CSMP) was developed, which was a cooperative effort between NMFS, CDFG and the Sonoma Ecology Center. This plan provides a sampling framework to collect information at the appropriate life stages and spatial scales to evaluate adult salmonid abundance both at larger regional scales and at the population level. The CSMP design also allows basic assessments of connectivity through the collection of juvenile distribution and relative abundance data. Measurements of diversity will be based on local evaluation of essential life history variants and both broad and focused assessments of genetic diversity patterns. The monitoring framework provided by the CSMP is expected to provide public and private stakeholders with general information on population estimates at each life-history stage, and also provide a monitoring framework for other management activities such as hatchery operations and fisheries management. A three-year pilot project to implement the CSMP in coastal Mendocino County was finalized in 2008 (Gallagher & Wright, 2008). Results from the pilot study suggest that a sample size of ≥ 40 reaches is needed to provide sufficient

statistical power to detect regional trends in salmon population abundance. Gallagher & Wright (2008) recommend that the regional escapement monitoring approach be employed and tested at scales consistent with the needs for ESA recovery plan implementation and monitoring. Results from this study have improved our understanding of the sampling efforts needed to estimate salmonid population abundance.

The Northwest Forest Plan (NFP) is a Federal land management program aimed at improving freshwater habitat conditions for anadromous and other species on Federal lands in the range of the Northern spotted owl (*Strix occidentalis carina*). Under the NFP, the U.S. Forest Service (USFS) and the Bureau of Land Management (BLM) have made important efforts to reduce adverse impacts from their land management activities on aquatic and riparian dependent species such as the NC steelhead DPS. The most significant element of the NFP for anadromous fish is the Aquatic Conservation Strategy, which includes an objective for salmon habitat conservation. Continued implementation of the NFP on the Six Rivers is expected to provide significant benefits to the NC steelhead DPS.

As previously discussed, NMFS has developed guidance for the review, establishment, use, and operation of conservation banks and in-lieu fee mitigation programs to promote salmonid conservation. Ongoing and potential conservation bank programs include the Statewide Advance Mitigation Initiative (SAMI) Memorandum of Understanding (MOU) and the Regional Advanced Mitigation Project (RAMP) MOU as describe previously. The proposed Ten Mile River conservation and mitigation bank is a potential project that would protect the lower portion of the Ten Mile River and therefore provide conservation benefits to this DPS by improving freshwater habitat conditions.

State Efforts

Timber Harvest

Forest practice rules (FPRs) regulate management of non-Federal timberlands in California and are promulgated by a governor-appointed Board of Forestry (BOF). Because of the preponderance of private timber land and timber harvest activity in the NC steelhead DPS, the FPRs are critically important for the species conservation. The expected implementation of a 1998 NMFS/California Memorandum of Agreement (MOA) was a critical factor in NMFS' decision to not list this DPS as threatened in 1998 (63 FR 13347). The MOA committed the State to implement measures in the State Strategic Plan for steelhead, implement the California Watershed Protection Program, and review and revise (if found necessary) the State's FPRs. In accordance with the MOA, a scientific review panel was appointed to undertake an independent review of the FPRs. In 1999 the review panel concluded that the FPRs, including their implementation through the timber review process, did not ensure protection of anadromous salmonid habitats and populations. To address these shortcomings, and as specified in the MOA, the California Resources Agency and the California Environmental Protection Agency jointly presented the BOF with a proposed rule change package in July 1999.

The State's Threatened and Impaired Value Rules (T/I rules) were developed and intended to minimize impacts to salmonid habitat resulting from timber harvest by requiring management

actions in watersheds with State and Federally listed threatened, endangered, and or candidate populations of anadromous salmonids. Following several months of public review, the BOF took no action on the package in October 1999, thereby precluding any possibility of implementing improvements in California's FPRs by January 1, 2000, as the State had committed in the MOA. The California State Legislature gave special authority to the BOF to adopt new rules twice during the year 2000 for the specific purpose of revising the State's FPRs to meet ESA requirements for salmonids. On March 14, 2000 the BOF adopted only a subset of rule changes. It was determined the full implementation of these provisions was critically important to protecting the habitat of the NC steelhead DPS.

NMFS' decision to list the NC steelhead DPS as a threatened species (65 FR 36074) was largely due to the BOF approving only a portion of the 1999 T/I rule package and not fully implementing critically important conservation measures (e.g., Class II and Class III protections). In July 2000, CDFG began imposing stricter guidelines to protect and restore watersheds with threatened or impaired values (T/I rules). Examples of the special management actions required include constructing watercourse crossings that allow for unrestricted fish passage, increasing large woody debris recruitment, increasing soil stabilization measures, and requiring coordination between CDFG and the State and Regional Water Quality Control Boards to minimize sediment discharge. The T/I rules were never permanently adopted, but instead have been re-authorized by CDFG numerous times since their inception in 2000. The T/I rules were replaced by the Anadromous Salmonid Protection (ASP) rules in 2010. The Board's primary objectives in adopting the ASP rules were to: (1) ensure rule adequacy in protecting listed anadromous salmonid species and their habitat, (2) further opportunities for restoring the species' habitat, (3) ensure the rules are based on credible science, and (4) meet Public Resources Code (PRC) § 4553 for review and periodic revisions to the FPRs.

The effects of past and present timber harvest operations still represent a threat to steelhead in this DPS. The Habitat Conservation Plan (HCP) process under section 10 of the ESA was developed to provide incentives to non-federal land managers and private landowners to help protect listed and unlisted species while allowing some development to occur that may potentially harm listed species. NMFS is currently engaged in an ongoing effort to assist in the development of HCPs for State and private lands in California. There are three important HCPs that likely have contributed to the conservation of steelhead in this DPS. These include the Pacific Lumber Company (PALC0) HCP, the Green Diamond Resource HCP and the Humboldt Bay Municipal Water District HCP.

The Humboldt Redwoods Company (HRC and formerly PALCo) HCP was finalized in 1999 and is valid through 2049. The HCP covers approximately 210,000 acres of industrial timberlands in northern California and includes mitigation strategies related to timber management, forest road construction and maintenance, and rock quarrying. The HCP includes three major rivers within the NC steelhead DPS: the Eel River, Van Duzen River, and Mattole River. The goals of the HCP are to achieve and move towards properly functioning aquatic conditions for anadromous salmonids within the management area covered by the HCP. To ensure habitat goals are met, the HCP relies heavily on watershed analysis, monitoring, and adaptive management tools. The most recent HRC monitoring report (HRC, 2009) indicated that approximately 44% of the habitat

objectives in the HCP are being met which represents a 3% improvement since 2008 and a 4% improvement since 2002.

The Green Diamond Resource Company (GDRC) HCP was finalized in 2006 and is valid through 2056. The HCP covers approximately 410,000 acres in coastal northern California. The HCP affects all coastal steelhead populations in the Eel and Van Duzen Rivers. One of the major mitigation activities of the GDRC HCP include removing 50% of high and moderate priority road sites within the first 15 years of plan implementation. These measures, coupled with provisions for riparian protection, mass wasting prevention, and adaptive management ensure that adverse impacts to steelhead rearing, migration, and spawning habitats are minimized or avoided. The first biennial report for the Green Diamond HCP was submitted to NMFS in 2009 (GDRC, 2009). The report focused primarily on laying a foundation for future monitoring efforts, and reported baseline environmental conditions (e.g., turbidity levels, stream temperatures) for future comparison. The HCPs are expected to improved management of private timberlands in northern California. At this time, it is not possible to evaluate changes in NC steelhead habitat conditions resulting from HCP implementation.

Despite the benefits to anadromous salmonid habitat resulting from implementation of the HRC and GDRC HCPs, timber harvest within the range of the NC steelhead DPS continues to be a threat. NMFS staff have actively engaged and participated in BOF meetings and expressed concern to the BOF that the ASP rules, while resulting in some improvements to riparian protections, will not adequately protect anadromous salmonids until several inadequacies in the FPRs are addressed. Specifically, NMFS believes that take of listed salmonids associated with timber harvest operations in California could be minimized (but not entirely avoided) if the following additional protections were added to the existing ASP rules: (1) provide Class II-S (standard) streams with the same protections afforded Class II-L (large) streams, (2) include provisions to ensure hydrologic disconnection between logging roads and streams, and (3) include provisions to avoid hauling logs on hydrologically connected streams during winter periods. In addition NMFS believes the use of scientific guidance will provide additional limitations in the rate of timber harvest in watersheds to avoid cumulative impacts of multiple harvests, and provide greater protections to ensure the integrity of high gradient slopes and unstable areas. This may include limiting the areal extent of harvest in such areas.

In summary, NMFS is working collaboratively with the BOF to limit the effects of forestry operations on threatened and endangered salmonids populations. At this time, however, the effects of past and present timber harvest activities continue to be an ongoing threat to the NC steelhead DPS.

Roads

In June, 2007, NMFS approved the Five Counties Salmon Conservation Program for routine road maintenance under limit 10 of the 4(d) rule for threatened salmon and steelhead. This manual (entitled: " A Water Quality and Stream Habitat Protection Manual for County Road Maintenance in Northwestern California Watersheds") includes best management practices (BMPs) for reducing impacts to listed species and the aquatic environment, a five-county inventory and prioritization of all fish passage barriers associated with county roads, annual

training of road crews and county planners, and a monitoring framework for adaptive management .

FishNet 4C is a multi-county group comprised of Mendocino, Sonoma, Marin, Santa Cruz San Mateo and Sonoma counties. This group coordinates county efforts such as road maintenance, fish barrier assessment and removal, riparian and proposed and existing grading ordinances, erosion control, implementation of bioengineering projects and the development of guidelines for public works departments to enhance or protect salmonid habitat.

Federal Water Management

In 2002, NMFS issued a biological opinion which addressed the impacts to coho salmon, Chinook salmon and steelhead from hydropower generation at the Potter Valley powerhouse and the Lake Mendocino powerhouse under current and future (2020) sediment conditions and water diversions from the Eel River Basin to the Russian River Basin. The jeopardy biological opinion contained a reasonable and prudent alternative (RPA) that called for implementing changes in river flow that would more closely resemble the natural hydrograph (NMFS, 2002). The actions required by the RPA were expected to substantially improve habitat conditions and survival rates for listed salmonids including steelhead in this DPS.

The Federal Clean Water Act (CWA) which is administered by the Environmental Protection Agency (EPA) is intended to protect beneficial uses of water, including consideration of habitat for anadromous salmonids and other fishery resources. In practice, implementation of the CWA has not provided the desired level of protection for fishery resources, particularly with respect to non-point sources of pollution. Section 303(d)(1)(C) and (D) of the CWA requires states to prepare Total Maximum Daily Loads (TMDLs) for all water bodies that do not meet State water quality standards. TMDLs are a method for quantitative assessment of environmental problems in a watershed and identifying pollution reductions needed to protect drinking water, aquatic life, recreation, and other use of rivers, lakes, and streams. EPA established TMDLs for various constituents (sediment, pathogens, pesticides, nutrients, temperature and DO, etc) in the range of this DPS and the State of California is developing or has developed TMDLS for a number of impaired water bodies identified on the 303(d) list.

Many pesticides are applied in watersheds supporting salmon and steelhead to control pests associated with agricultural crops, residential homes, commercial and industrial facilities, transportation corridors, parks, golf courses, and timberlands. They can be transported to salmon habitats as a result of point source (e.g., discharges from industrial and municipal outfalls) and non-point source (e.g., agricultural and urban runoff) pathways. The direct impact of pesticides (and pesticide mixtures) on salmon health is an emerging research focus (Eder et al. 2009; Laetz et al. 2009) in the context of population recovery (Baldwin et al. 2009); however, the indirect impacts of pesticides on salmonids via their supporting aquatic food webs remain poorly understood (MacNeal et al. 2010). Results by Baldwin et al. (2009) indicate that short-term (i.e., four-day) exposures which are representative of seasonal pesticide use may be sufficient to reduce the growth and size at ocean entry of juvenile steelhead. Overall, results indicate exposure to common pesticides may place important constraints on the recovery of ESA-listed salmon species, and that simple models can be used to extrapolate toxicological impacts across

several scales of biological complexity (Baldwin et al., 20009). Despite these gaps, there is considerable evidence that pesticides may have toxic effects on the biological communities that support ESA-listed salmon (reviewed in NMFS 2008, 2009). The EPA has initiated section 7 consultation with NMFS' Office of Protected Resources for re-registering 37 pesticide active ingredients. Two biological opinions have been completed with NMFS concluding that: (1) the use of organophosphates (chlorpyrifos, diazinon, and malathion) is likely to jeopardize the continued existence of 27 listed salmonids ESUs and DPSs (NMFS, 2008) and (2) the use of carbamates (carbofuran, and carbaryl) and methomyl are likely to jeopardize the continued existence of 22 ESUs/DPSs and 18 ESUs/DPSs of listed salmonids, respectively (NMFS, 2009). NMFS also determined that carbaryl, carbofuran and methomyl are likely to result in the destruction or adverse modification of critical habitat for 20 and 16 ESUs/DPSs, respectively, because of adverse effects on prey and water quality in freshwater rearing and spawning habitats and foraging areas. The jeopardy opinions contained reasonable and prudent alternatives and measures for reducing agricultural drift and runoff of pesticide products into aquatic habitats. The opinions noted that more data is needed to evaluate the efficacy of the RPAs for reducing impacts of these pesticides, with a particular focus on water and off-channel habitats; however, they also noted that it was uncertain whether the RPAs effectively control pesticides at their sources. Biological opinions for the remaining 31 pesticide active ingredients (insecticides, herbicides and fungicides) are ongoing and are expected to be completed by 2012.

Historically, the impacts to fish habitat from agricultural practices have not been closely regulated. The State of California does not have regulations that directly manage agricultural practices, but instead relies on the TMDLs under the CWA to improve water quality from all sources and parties, including agricultural sources. The majority of TMDLS focus on sediment and temperature requirements and few focus on pesticide toxicity-the number one cause of stream impairment in California. Numerous streams within the range of this DPS are currently impacted by agricultural practices, but do not have established TMDLs (SWRCB, 2010) and many are not scheduled for completion until 2019. In some instances, TMDLs may address all pollution sources including point sources such as sewage or industrial plant discharges, and non-point discharges such as runoff from roads, farm fields, and forests. TMDLs have the potential to provide long term benefits to listed salmonids and their habitat, but it will take time to develop and implement TMDL standards and to determine the magnitude of the benefits. Agricultural activities continue with minimal regulation and represent a threat to steelhead survival and recovery in this DPS

State Water Management

The State Water Resources Control Board (SWRCB) Division of Water Rights administers a water rights permitting system which controls utilization of waters for beneficial uses throughout the State. This system, while it contains provisions (including public trust provisions) for the protection of in-stream aquatic resources, does not provide an explicit regulatory mechanism to implement DFG Code Section 5937 requirements to protect anadromous fish populations such as steelhead below impoundments. Additionally, SWRCB generally lacks the oversight and regulatory authority over groundwater development comparable to surface water developments for out-of-stream beneficial uses.

On September 28, 2011, the State Water Board adopted a policy for water quality control titled "Policy for Maintaining Instream Flows in Northern California Coastal Streams". The policy contains principles and guidelines for maintaining instream flows for the purposes of water right administration and addresses coastal streams ranging from the Mattole River southward to San Francisco, including streams entering northern San Pablo Bay. This geographic area encompasses all or parts of five counties (Marin, Sonoma, Napa, Mendocino and Hunboldt) and overlaps with the geographic range of the NC steelhead and CCC steelhead DPSs. The instream flow policy is effective until 2013 during which time a three-year Pre-decisional Trial Program is being implemented.

The North Coast Regional Water Quality Control Board (NCRWQB) recently updated its North Coast Basin Plan to establish water quality standards for all of the northern California rivers and streams. These plans incorporate newly developed TMDL standards which were developed for those water bodies listed as impaired under section 303(d) of the CWA.

Private lands and public lands not administered by the Federal government are currently being addressed by the California Rangeland Water Quality Management Program. Additionally, the Rangeland Management Advisory Committee developed a management plan for inclusion in the State's Non-point Source Management Plan. The purpose of the plan was to maintain and improve the quality and associated beneficial uses of surface water passing through rangeland resources. The program enhances the ability of landowners to manage their land in a way that protects water quality standards necessary for the survival and recovery of listed salmonids (65 FR 36074 at 36086). These plans have likely reduced rangeland impacts on aquatic habitata and thereby reduced impacts on steelhead populations in this DPS.

Overall, most Federal and State water management regulatory mechanisms are limited in their ability to provide robust protections for steelhead in this DPS or their habitat and are relatively unchanged since the last status review. As a consequence, they are a continuing threat to the DPS.

Dredge, Fill, and Instream Construction Programs

The Corps of Engineers regulates removal/fill activities under section 404 of the CWA. The regulations under section 404 provide limited protections for steelhead or their habitat in this DPS because they only address activities that result in direct filling or dredging of waters (e.g., upland activities are generally excluded) and do not adequately address cumulative impacts from multiple projects. Similarly, the section 401 water quality certification program under the CWA only applies to activities that require a federal permit or license (i.e., 404 permit or FERC license, respectively). Because the 401 certification requirements depend on the initiation of the 404 permitting or FERC licensing process, the 401 program also does not address exclusively upland activities. Therefore, the lack of review and jurisdiction for upland activities limits the ability of the 404 and 401 regulatory programs to protect steelhead or their habitat in this DPS. State agencies responsible for dredge and fill permits includes the Regional Water Quality Control Boards and, in some cases, the CDFG. The State attempts to minimize or prevent habitat degradation through the development of standardized permit conditions incorporating

best management practices for removal and fill activities and through strengthening interagency coordination in removal and fill permitting.

The Federal Emergency Management Agency (FEMA) administers a National Flood Insurance Program (NFIP) which influences development in waterways and floodplains. Regulations allow for development in the margins of active waterways if they are protected against 100-year flood events and do not raise the water elevations within the active channel (floodway) more than one foot during such flood events. This standard does not consider the dynamic, mobile nature of watercourses and the critical role that margins of active waterways (riparian areas) play in the maintenance of aquatic habitats within the range of this DPS. FEMA programs for repairing flood related damages (Public Assistance Program, Individual and Households Program, and Hazard Mitigation Grant Program) promote the replacement of damaged facilities and structures in their original locations, which are prone to repeated damage from future flooding, and thus lead to repeated disturbance of riparian and aquatic habitats important to listed salmonids including steelhead in this DPS.

In September of 2008, NMFS issued a biological opinion that concluded implementation of the NFIP jeopardizes several salmon and steelhead species in Puget Sound and also adversely modifies their habitat. In the biological opinion NMFS provided a reasonable and prudent alternative that would require modification of the manner in which the NFIP is implemented. FEMA has been working to produce and execute an implementation plan to address the RPA.

2.3.2.5 Other natural or manmade factors affecting its continued existence

Climate Change

Overview

In the Pacific Region, global climate change will lead to changes in freshwater environments. The biological implications of physical habitat changes on Pacific salmon are significant as changes in timing/magnitude of flow and thermal regimes are linked to behavioral and physiological responses of freshwater life stages. Human activities can affect biophysical changes by imposing additional stressors such as unsustainable exploitation rates on vulnerable populations, or reducing water availability in stressed areas, or restoration actions which may include adjusting harvest rates, or changing management of freshwater supplies to mitigate against low summer flows during adult migration and spawning.

New information since this DPS was listed suggests that the Earth's climate is warming as a result of the accumulation of greenhouse gasses in the atmosphere (IPCC, 2007; CCPS, 2008). The Intergovernmental Panel on Climate Change (IPCC) concluded in 2007 that warming of the climate system is now "unequivocal," based on observed increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level (IPCC, 2007). Salmon and steelhead from California to the Pacific Northwest are now challenged by global warming induced alteration of habitat conditions throughout their complex life cycles (Mantua and Francis, 2004; ISAB, 2007; Glick, 2005; Martin and Glick, 2008; Glick et al. 2009). Salmon productivity in California and the Pacific Northwest is clearly sensitive to

climate-related changes in stream, estuary, and ocean conditions. These changes could alter freshwater habitat conditions and affect the future survival and recovery potential of Pacific salmon and steelhead stocks. Specific characteristics of a population or its habitat that are vulnerable to climate change include temperature requirements, reliance on snowpack, suitability of available habitat, and the genetic diversity of the DPS.

Temperature and Precipitation

According to National Oceanic and Atmospheric Administration's (NOAA) 2008 State of the Climate Report and National Aeronautics and Space Administration's (NASA) 2008 Surface Temperature Analysis; since the mid-1970s, the average surface temperature has warmed about 1°F. The Earth's surface is currently warming at a rate of about 0.29ºF/decade or 2.9°F/century, and the eight warmest years on record (since 1880) have all occurred since 2001, with the warmest year being 2005. The range of surface water temperatures are likely to shift resulting in higher high temperatures as well as higher low temperatures in streams. A recent study in of the Rogue River basin determined that annual average temperatures are likely to increase from 1 to 3° F (0.5 to 1.6° C) by around 2040 and 4 to 8° F (2.2 to 4.4° C) by around 2080. Summer temperatures may increase dramatically reaching 7 to 15° F (3.8 to 8.3° C) above baseline by 2080, while winter temperatures may increase 3 to 8°F (1.6 to 3.3° C) (Doppelt et al. 2008). Changes in temperature throughout the NCCC Recovery Domain are likely to be similar. A study by Littell et al. (2009) suggest that one third of the current habitat for endangered and threatened Northwest salmon species will no longer be suitable for salmonids by the end of this century as key temperature thresholds are exceeded. The variability in temperature that we are likely to observe within a specific stream or stream reach depend on factors such as riparian condition, groundwater and spring influence, the presence of upstream impoundments, and stream flow (Bartholow, 2005). Increases in fall and winter temperature regimes might shorten hatching and emergence for developing eggs leading to lower survival rates (Burger et al. 1985). Higher spring temperatures will increase the growth rates of fry. Increases in summer temperatures will lead to thermal stress, decreased growth and affect survival of outmigrating juveniles.

The increase in winter water temperatures may be intensified since stream flow in many streams is expected to decrease as a result of decreasing snowpack melt. Recent projections indicate that snow packs in northern California and southern Oregon will decrease by 60-75% by 2040 and will disappear almost completely by 2080. Levels will be less than 10 inches SWE (snow water equivalent) in the few areas where snowpack remains (Doppelt et al. 2008; Luers et al. 2006). This loss of snowpack will likely lower spring and summertime flows while additional warming may cause earlier onset of runoff in streams. Changes in runoff patterns may ultimately influence the survival of smolts.

Annual precipitation could increase by up to 20% in northern California. Most precipitation will occur during the mid-winter months as intense rain and rain-on-snow events that will be linked to higher numbers of landslides and greater and more severe floods (Doppelt et al. 2008; Luers et al. 2006). Overall, there will be earlier and lower low-flows and earlier and higher high-flows. Increased flooding will likely cause eggs to be scoured from their nests; displace overwintering juveniles; and contribute to higher summer water temperatures.

Sea level rise

Sea level is expected to rise exponentially over the next 100 years, and is estimated to rise 50-80 cm by the end of the 21st century (USGCRP, 2002). As a result of sea level rise, low lying coastal areas will eventually be inundated by seawater or periodically over-washed by waves and storm surges. Coastal wetlands will become increasingly brackish as seawater inundates freshwater wetlands. New brackish and freshwater wetland areas will be created as seawater inundates low lying inland areas or as the freshwater table is pushed upward by the higher stand of seawater (Pfeffer et al. 2008). The rise in sea level will alter the habitat in estuaries and either provide increased opportunity for feeding and growth of salmon or in some cases will lead to the loss of estuarine habitat and a decreased potential for estuarine rearing.

In 2009, the Pacific Institute released a study on the impacts of sea-level rise on the California coast which included a detailed analysis of the current population, infrastructure, and property at risk from projected sea-level rise if no actions are taken to protect the coast. Key findings in the report are that: 1) a sea-level rise of 1.4 m would flood approximately 150 miles of land immediately adjacent to current wetlands, potentially creating new wetland habitat if those lands are protected from further development; 2) approximately 1,100 miles of new or modified coastal protection structures are needed on the Pacific Coast and San Francisco Bay to protect against coastal flooding and 3) continued development in vulnerable areas will put additional areas at risk and raise protection costs (Heberger et al. 2009).

NOAA is currently developing a strategic approach to integrate its coastal activities, with a specific focus on helping improve risk assessment and adaptation to climate change in coastal areas. Significant efforts are underway for improving the design, development, and delivery of effective climate services to NOAA and other stakeholders through a National Climate Service (Griffis et al. 2009). Furthermore, to aid in NMFS's understanding of the impacts of sea level rise on coastal communities, NOAA's Coastal Services Center provides a number of new mapping tools and techniques for visualization of sea level rise and coastal flooding impacts such as, the Sea-level Rise and Coastal Flooding Impacts Viewer that: (1) display future sea level rise, (2) provides simulations of sea level rise at local landmarks, (3) communicates the spatial uncertainty of mapped sea level rise, (4) models potential marsh migration, (5) overlays social and economic data on potential sea level rise and 6) examines how tidal flooding will become more frequent with sea level rise. These tools/techniques are expected to increase our understanding of the impacts of sea level rise on salmonids habitats (Douglas et al. 2011).

Coastal and Marine Environments

The ocean plays a major role in regulating the weather and climate of the planet, and understanding the factors that impact the Earth's weather and climate, and how changes in temperature or air circulation are part of complex, long-term cycles. Understanding the influence of dynamic ocean conditions on the Earth's climate and monitoring changes in ocean conditions are key to predicting climate change.

Marine ecosystems will change as a result of global climate change; many of these changes will likely have deleterious effects on salmon growth and survival while at sea. There is great uncertainty about the effects of changing climate on marine ecosystems given the high degree of complexity and the overlapping climatic shifts that already exist (e.g. El Niño, La Niña, and Pacific Decadal Oscillation). El Nino events and periods of unfavorable ocean conditions threaten the survival of salmon and steelhead populations that are at low numbers due to degradation of estuarine habitats and reduced food availability (NMFS, 1996a). Current and projected changes in the North Pacific include rising sea surface temperatures that increase the stratification of the upper ocean; changes in surface wind patterns that impact the timing and intensity of upwelling of nutrient-rich subsurface water; and increasing ocean acidification which will change plankton community compositions with bottom-up impacts on marine food webs (ISAB, 2007). Ocean acidification also has the potential to dramatically change the phytoplankton community due to the likely loss of most calcareous shell-forming species such as pteropods. Recent surveys show that ocean acidification is increasing in surface waters off the west coast, and particularly the northern California coast, more rapidly than previously estimated (Feely et al. 2008). Shifts in prey abundance, composition, and distribution are the indirect effects of these changes.

Direct effects are decreased growth rates due to ocean acidification and increased metabolic costs due to the rise in sea surface temperature (Portner and Knust, 2007). Northwest salmon and steelhead populations have fared best in periods having high precipitation, deep mountain snowpack, cool air and water temperatures, cool coastal ocean temperatures, and abundant north-to-south "upwelling" winds in spring and summer. Because conditions may be warmer and upwelling may be delayed, salmon and steelhead may encounter less food or may have to travel further from their home ranges to find satisfactory habitat, increasing energy demands, slowing growth and delaying maturity (ISAB, 2007).

Since the last status review (Good et al. 2005), much more information regarding the impacts of predicted shifts in climate has become available. Global average surface temperature increased by approximately 0.7°C during the 20th Century and appears to be accelerating (IPCC, 2007) with the global trend over the past 50 years being nearly twice the historical rate. Regional trends in temperature show even greater warming tendencies. In general, it is estimated that conditions for salmon in California will change dramatically over the coming decades.

A number of Federal, state and local adaptive/action plans have been developed for the U.S. and the State of California. For example, in 2010 NOAA released the Adapting to Climate Change: A Planning Guide for State Coastal Managers document and sea level inundation toolkit to help U.S. state and territorial (states) coastal managers develop and implement adaptation plans to reduce the risks associated with climate change impacts (NOAA, 2010b). In 2008, under the Executive Order S-13-08 signed by the Governor of California, the state began to develop state-wide and local climate adaption/action plans that focus on topics such as, economy, ecosystem/natural resources, human health, infrastructure, society and water resources. In 2009, the California Natural Resources Agency released the California Climate Adaptation Strategy document. Many of the issues discussed in this document address the impacts of sea level rise, drought, flooding, air temperature and precipitation on the topics mentioned above. In the NCCC Recovery Domain, climate adaption/action plans have been developed for the San

Francisco Bay (Climate Change Hits Home: Adaptation Strategies for the San Francisco Bay Area, 2011); the City of San Rafael (City of San Rafael Climate Change Action Plan); and the City of Berkeley (Berkeley Climate Action Plan).

In the future, climate change will likely surpass habitat loss as the primary threat to the conservation of most salmonid species including steelhead in this DPS (Thomas et al. 2004). Climate change will continue to pose an ongoing threat to salmonids in the foreseeable future throughout California and the Pacific Northwest (Battin et al. 2007). Overall, climate change is believed to represent a growing threat to steelhead in both DPS.

Stochastic Pressure from Small Population Size

Random events in small populations may have a large impact on population dynamics and the ability of a population to persist. The peril small populations face may be either deterministic, the result of systematic forces that cause population decline (e.g., overexploitation, development, deforestation, loss of pollinators, inability to find mates, inability to defend against predators), or stochastic (the result of random fluctuations that have no systematic direction). If the rate of population growth varies from one generation to the next, a series of generations in which there are successive declines in population size can lead to extinction even if the population size is growing on average over the long term.

As noted in section 2.3.1, many populations of steelhead in both DPSs have declined in abundance to levels that are well below low-risk abundance targets, and several are, if not extirpated, likely below the high-risk depensation thresholds specified by Spence et al. (2008). These populations are potentially at risk from natural stochastic processes, in addition to deterministic threats, that may make recovery of steelhead more difficult. As natural populations get smaller, stochastic processes may cause alterations in genetics, breeding structure, and population dynamics that may interfere with the success of recovery efforts and need to be considered when evaluating how populations respond to recovery actions. This stochastic pressure can express itself in three ways: genetic, demographic and environmental.

Genetic stochasticity refers to changes in the genetic composition of a population unrelated to systematic forces (selection, inbreeding, or migration), i.e., genetic drift. It can have a large impact on the genetic diversity of populations, both by reducing the amount of diversity retained within populations and by increasing the chance that deleterious recessive alleles may be expressed. The loss of diversity could limit a population's ability to respond adaptively to future environmental changes. The increased frequency with which deleterious recessive alleles are expressed could reduce the viability and reproductive capacity of individuals. Demographic stochasticity refers to the variability in population growth rates arising from random differences among individuals in survival and reproduction within a season. This variability will occur even if all individuals have the same expected ability to survive and reproduce and if the expected rates of survival and reproduction don't change from one generation to the next. Stochasticity occurs in all populations, it is generally important only in smaller populations. Environmental stochasticity is define as the variability in population growth rates that refer to variations in birth and death rates from one season to the next in response to weather, disease, competition, predation, or external factors.

Two important changes have occurred with regard to this listing factor since the last status review in 2005. First, we now recognize climate change as a serious risk to salmon and steelhead ESUs and DPSs in California. The best available scientific information indicates that the Earth's climate is warming, driven by the accumulation of greenhouse gasses in the atmosphere (Oreskes, 2004; Battin et al. 2007; Lindley et al. 2007). Because both of these steelhead DPSs depend upon freshwater streams and the ocean during different stages of their life history cycle, populations throughout both DPS, but particularly at the southern end of its range for CCC steelhead, are likely to be significantly impacted by climate change in the future. Second, the potential risks of stochastic processes associated with small population size are believed to have increased over the past five years thereby likely placing populations in both DPSs at a higher risk of extinction.

Artificial Propagation

CCC steelhead DPS

During the last status review, NMFS concluded that the two artificial propagation programs that are part of this DPS (Don Clausen and Kingfisher Flats) were likely to provide some limited benefit to DPS viability by contributing to local population abundance, but that they did not substantially reduce extinction risk to the DPS as a whole. Genetic diversity risk associated with out-of-basin transfers appeared to be minimal, but diversity risk from domestication selection and low effective population sizes in the remaining hatchery programs remained a concern. Since the last review, there have not been any significant changes to either hatchery program, and therefore, the effects of these programs on DPS viability are unchanged.

NC steelhead DPS

During the last status review, NMFS concluded that the two artificial propagation programs that are part of this DPS (Yager Creek and NF Gualala) were likely to provide some limited benefit to DPS viability by contributing to local population abundance; but that they did not substantially reduce extinction risk to the DPS as a whole. Since the last review, both programs have been terminated and so any benefits to the DPS no longer exist. The Mad River hatchery program continues to operate within this DPS, but is not considered part of the DPS. Management of this hatchery program has not changed substantially since the last review and continues to represent a risk to overall DPS viability.

2.3.3 Synthesis

CCC Steelhead DPS

The CCC steelhead DPS was originally listed as a threatened species in 1999 (62 FR 43937) and includes all steelhead populations in watersheds ranging from the Russian River (inclusive) south to Aptos Creek (inclusive), as well as the drainages entering San Pablo and Suisun Bays eastward to Chipps Island at the confluence of the Sacramento and San Joaquin Rivers. In a reconsideration of its listing status finalized in 2006, NMFS determined that two steelhead

artificial propagation hatchery stocks were also part of the DPS and that it continued to be a threatened species (71 FR 834). Since 2006, both hatchery programs continue to be operational and propagate stocks that are considered part of the DPS. Ancillary data on population abundance and genetic data from steelhead populations in Scott Creek indicate that a high proportion of returning fish are of hatchery origin (approximately 65%). These results led NMFS to classify the Scott Creek population as being at a moderate risk of extinction (Good et al. 2005; Williams et al. 2011). Other than the aforementioned Scott Creek population, there is limited data to access the adult population sizes throughout the remainder of the DPS. Since publication of the last status review (Good et al. 2005), significant new genetic data are available for steelhead populations across much of coastal California. Review of this data by numerous sources (Garza et al. 2004; Clemento et al. 2009; Pearse et al. 2010; Aquilar et al. unpublished data) suggest that boundaries changes may be warranted for CCC steelhead DPS. A BRT has been convened to evaluate these new data and other relevant information related to coastal seelhead DPS boundaries. This review is based on the existing DPS boundaries.

The status review update conducted by the SWFSC concluded that the lack of population-level abundance estimates for this DPS continues to hinder an assessment of its status (Williams et al., 2011). Based on the new information since the last status review, however, there is no evidence suggesting that there has been a substantial change in the biological status of the DPS since the last review (Good et al. 2005). The updated status review did cite several concerns about the DPS including the uncertainty about population abundance of nearly all independent populations, and the high numbers of hatchery fish in the Russian River. Also of concern is the status of the populations in the San Francisco Bay area, particularly those where historical habitat is now inaccessible (Williams et al. 2011). These concerns were generally recognized at the time of the previous status review, but were considered more significant in this review given the recently developed population viability criteria for this DPS. Although salmon conservation efforts have improved some habitat conditions within the DPS since it was last reviewed in 2005, continuing threats related to each of the five listing factors (see section 2.3.2) have remained largely unchanged since the last review (Good et al. 2005 and 72 FR 834). One important change is that we now recognize potential habitat impacts related to ongoing and future climate change constitute a new and serious threat to the DPS.

In summary, the best available updated information on the biological status of the CCC steelhead DPS and the threats it faces indicate that it continues to remain a threatened species. The two hatchery stocks continue to be operational and propagate stocks that are considered part of the DPS. Potential DPS boundary changes are under review and will be addressed in the future if warranted. Increased focus should be given to addressing the potential threats to this DPS from exposure to common pesticides that may constrain recovery. Lastly, the potential impacts of climate change are now recognized as a major threat to this DPS and may surpass habitat loss as the primary threat to its conservation in the future.

NC steelhead DPS

The NC steelhead DPS was originally listed as a threatened species in 2000 (61 FR 36074) and comprises all winter-run and summer-run steelhead populations from Redwood Creek (Humboldt County) southward to, but not including the Russian River. In 2006, NMFS

reaffirmed that this DPS was a threatened species and also listed two hatchery stocks as part of the DPS (71 FR 834). Based on this review, we have determined that these two hatchery stocks (Yager Creek and NF Gualala River) have been terminated and should no longer be listed as part of the DPS. The Mad River hatchery stock was not included in the DPS in 2006 (71 FR 834), but it continues to be operational and a potential risk to the DPS. Since publication of the last status review (Good et al. 2005), significant new genetic data are available for steelhead populations across much of coastal California. Review of this data by numerous sources (Garza et al. 2004; Clemento et al. 2009; Pearse et al. 2010; Aquilar et al. unpublished data) suggest that boundaries changes may be warranted for NC steelhead DPS. A BRT has been convened to evaluate these new data and other relevant information related to coastal steelhead DPS boundaries. This review is based on the existing DPS boundaries.

Extant summer-run steelhead populations are found in Redwood Creek and the Mad, Eel (Middle Fork) and Mattole Rivers. Spence et al. (2008) concluded that adult abundance information for independent populations of steelhead in this DPS were insufficient to rigorously evaluate their viability using criteria developed by the TRT. However, the TRT concluded Bucknell Creek and Soda Creek are at a moderate/high risk of extinction based on low return counts at Van Arsdale Fish Station and the dominance of those counts by hatchery fish. The Upper Eel River was consider to be at a high risk of extinction due to the loss of habitat above Scott Dam and the high proportion of hatchery fish returning to Van Arsdale. Smaller populations including the Noyo River, Hare Creek, Pudding Creek, and Casper Creek were deemed at moderate risk of extinction if fish abundance remained unchanged over time (Spence et al. 2008).

The status review update conducted by the SWFSC concluded that the lack of population-level estimates of abundance for steelhead populations in this DPS continues to hinder assessment of its status (Williams et al. 2011). The updated status review did, however, cite several concerns about the DPS including the continued depressed status of two remaining summer-run populations in the DPS (Redwood Creek and Mattole River), the high number of hatchery fish in the Mad River basin, and the uncertainty about the relative abundance of hatchery and wild spawners in the Mad River. The previous status review of Good et al. (2005) concluded that the population was likely to become endangered in the foreseeable future. Based on a consideration of all new substantive information on the biological status of the DPS, the SWFSC concluded that its biological status was unchanged (Williams et al. 2011).

Although conservation efforts have reduced some threats facing this DPS, the threats highlighted in the five listing factor discussion in section 2.3.2 have with few exceptions remained unchanged since the last review (Good et al. 2005; 71 FR 834). One important change is that we now recognize potential habitat impacts related to ongoing and future climate change represent a new and serious threat to the DPS.

In summary, the best available updated information on the biological status of the NC steelhead DPS and the threats it faces indicate that it continues to remain a threatened species. Because the two hatchery stocks that were included in the DPS in 2006 no longer exist, they should be removed from the DPS. Potential DPS boundary changes are under review and will be addressed in the future if warranted. Increased focus should be given to addressing the potential threats to this DPS from exposure to common pesticides that may constrain recovery. Lastly, the potential

impacts of climate change are now recognized as a major threat to this DPS and may surpass habitat loss as the primary threat to its conservation in the future.

3.0 RESULTS

3.1 Recommended Classification

CCC steelhead DPS

Based on the updated biological status of this DPS, new information on the status of hatchery stocks in the DPS, and an updated review of the five listing factors and relevant conservation efforts, we recommend the DPS remain listed as threatened.

NC steelhead DPS

Based on the updated biological status of this DPS, new information on the status of hatchery stocks in the DPS, and an updated review of the five listing factors and relevant conservation efforts, we recommend this DPS remain listed as threatened.

3.2 New Recovery Priority Number

CCC Steelhead DPS

No change is recommended in the recovery priority number (3) for the CCC steelhead DPS.

NC steelhead DPS

No change is recommended in the recovery priority number (5) for the NC steelhead DPS.

3.3 DPS Boundaries and Hatchery Stocks

CCC steelhead DPS

Based upon the best available data and information, we do not recommend any changes be made to the current boundaries of this DPS or its hatchery stocks at this time. However, there is new genetic information suggesting that changes in the existing boundaries of this DPS may be warranted. The SWR and SWFSC have convened a BRT to compile and review all new biological, genetic, and ecological information relevant to determining the boundaries of this and several other coastal steelhead DPSs in California. Following completion of the BRT's review, the SWR will evaluate the new information and make a determination as to whether or not any boundary changes are warranted. If any such changes are warranted, the SWR will initiate the necessary rulemaking.

NC steelhead DPS

Based upon the best available data and information, we do not recommend any changes be made

to the current boundaries of this DPS at this time. We do, however, recommend that formal rulemaking be undertaken to remove two hatchery stocks from the DPS that have been terminated and no longer exist. Although we are not recommending any boundary changes at this time, there is new genetic information suggesting that some boundary changes may be warranted. The SWR and SWFSC have convened a BRT to compile and review all new biological, genetic, and ecological information relevant to determining the boundaries of this and several other coastal steelhead DPSs in California. Following completion of the BRT's review, the SWR will evaluate the new information and make a determination as to whether or not any boundary changes are warranted. If any such changes are warranted, the SWR will initiate the necessary rulemaking.

4.0 RECOMMENDATIONS FOR FUTURE ACTION

Recovery actions are under development for both the CCC and NC steelhead DPSs across their geographic range as part of a multi-species recovery planning effort for the NCCC Recovery Domain. The prompt and effective implementation of these actions will address the major threats to these DPSs and thereby promote their long term recovery. As such, the following recovery actions are the highest priority across both DPSs:

- Ensure extant populations of both steelhead DPSs are protected from harm or take and their habitat is protected from further degradation.
- Finalize NMFS' multi-species recovery plan for the NCCC recovery domain which addresses these two DPSs.
- Improve coordination between agencies, particularly with the SWRCB, to effectively protect unimpaired flows, address illegal water diversion, address off-stream reservoirs, and ensure that bypass flows are fully protective of steelhead. In particular, promote efficient water use practices and flow schedules adequate for appropriate steelhead life stage targets in highly developed areas.
- Promote restoration or rehabilitation projects in habitats most limiting for both DPSs including critical over-wintering habitats (such as alcoves, backchannels, off channel areas, estuaries and lagoons) and critical summer rearing habitat (such as complex pool habitat and unimpeded summer flows).
- Coordinate with local stakeholders to develop formal policy guidance on existing fish passage approaches. Improving fish passage approaches to reduce fish barriers (i.e., small and large scales dams) will enhance steelhead access to historical and suitable habitat upstream of dams so tht delisting criteria and recovery goals can be achieved. .
- Work with Federal and State agencies to finalize and implement Hatchery and Genetic Management Plans (HGMPs) to preserve genotypes, minimize inbreeding and outbreeding, and to ensure viable steelhead populations. The conservation actions required by HGMPs are expected to substantially improve the genetic viability and abundance of natural steelhead populations overtime and reduce the extinction risk cause by increased hatchery production.
- Work with Federal and State agencies to coordinate and develop programmatic permits for incidental take authorization for actions that contribute to the recovery of salmonid and their habitats, including streamlined estuary restoration for permitting through

NOAA's Restoration Center programmatic for non-Pacific Coast Salmon Restoration Fund (PCSRF) restoration projects.

- PCSRF funding should be appropriately allocated to prevent further decline of both DPSs and the restoration of their habitat. Adequate funding should also be allocated to monitoring of both DPSs.

Additional recommendations likely to benefit both DPSs include actions by NMFS and other Federal agencies, State of California agencies, counties, districts and other entities that address research and monitoring, restoration, and threat abatement. These actions are detailed below.

Agency Actions

- The ongoing effort by CDFG and NMFS to implement the California Coastal Salmonids Monitoring Program should continue. Funding and implementation of a coordinated program are necessary to enable tracking the status of both DPSs and their component populations, as well as the effectiveness of restoration and mitigation efforts for both DPSs. Collaboration is needed between the SWR and SWFSC to insure the monitoring program will meet the data needs to conduct status reviews for all ESA listed species.
- Finalize and implement Habitat Conservation Plans (HCPs) to facilitate recovery of both DPSs. .
- Conduct outreach to improve education and awareness for agencies, professional organizations, landowners, and the public regarding the importance and need for immediate and direct actions to prevent extinction and/or increase regulatory oversight on projects that may impair habitats or result in direct harm to salmon.
- Implement and enforce AB 2121, which codified (in sections 1259.2 and 1259.4 of the California Water Code) CDFG and NMFS' Water Diversion Guidelines to ensure protective flows for all life stages of salmon and steelhead.
- Work with CDFG to develop protective regulations to minimize impacts from fishing during migratory periods (e.g. until sandbars open naturally) within one mile of the river mouths in all focus watersheds and to modify freshwater sport fishing regulations to minimize take, and incidental mortality, of steelhead and other species through the development and implementation of fishery management and enhancement plans (FMEPs). Considerations may include low-flow closure thresholds, seasonal fishing closures, and angler outreach programs.
- Encourage amendments to Army Corp of Engineers (Corps) 404 Clean Water Act exemptions for farming, logging, and ranching activities to terminate Section 404(f) exemptions for discharges of dredged or fill material into US waters (channelization) associated with agriculture, logging, ranching and farming.
- Work with the California Board of Forestry, CalFire, CDFG, professional organizations and landowners to secure forest lands from conversion, promote sustainable forestry practices and provide incentives for growing large trees and conducting restoration actions. For example, modify the timber harvest permitting process to provide opportunities and incentives for LWD placement in streams during timber harvest operations.
- Promote programs that purchase land or develop conservation easements encouraging the protection, re-establishment and/or enhancement of natural riparian communities.

- Identify opportunities to review and develop conservation banks and in-lieu fee mitigation programs proposed in regional environmental planning documents and strategies.
- Support and engage CalTrans, FishNet 4C, counties, and others with oversight on road practices to reduce sediment delivery to streams from road networks and channelization from poorly situated roads. This should be accomplished through education, laws and policies designed to educate staff and road engineers and improve construction, maintenance, and decommissioning practices.
- Work with EPA, SWRCB, and local stakeholders to implement actions under section 303(d)(1)(C) and (D) of the Clean Water Act that requires states to prepare Total Maximum Daily Loads (TMDLs) for all water bodies that do not meet State water quality standards.
- Work with the SWRCB, the SWR's Habitat Conservation Division (HCD), and landowners to implement effective short-term and long-term water use strategies under the 2011 Russian River Frost Protection Regulations for the protection of listed steelhead and salmon.
- Work with EPA, and CDFG to identify and prioritize potential contaminants of concern and develop protective standards and programs in the NCCC recovery domain that directly or indirectly listed steelhead and salmon. .
- Identify opportunities to work with CDFG and the Corps to incorporate restoration projects with other actions, e.g., placement of LWD on gravel bars, to minimize impacts from in-stream graveling mining to protect steelhead as well as designated critical habitat for all ESA listed species.

Research and Monitoring

- Implement the 2011 California Coastal Salmonid Population Monitoring Plan (CSMP) to provide information on population abundance at the appropriate life stages and spatial scales to evaluate adult steelhead and salmon abundance (i.e., larger regional scales and population level). Conduct population research and monitoring that focuses on life stage survival (e.g., life cycle stations) within each Diversity Stratum including survival and fitness in wetland, estuaries and lagoons.
- Utilize existing population models and genetic information for each watershed and associated Diversity Stratum to identify minimum redd or adult counts that would trigger the need for augmentation or intervention.
- Implement monitoring programs to assess spawner abundance, population viability and key habitat attributes in all independent populations (i.e., functional independent populations). These programs will require consistent methods, reporting, databases and adaptive management across the NCCC recovery domain to evaluate population and habitat responses to recovery actions.
- Establish better inter- and intra-agency coordination regarding scientific research conducted on steelhead under ESA sections 7, 10, and 4(d). For example, work with local organizations, community groups, support environmental and community water quality monitoring projects that both document the scope and magnitude of pesticide exposure and build community capacity to advocate for better pesticide policy and practices.

- Partner with the Regional Water Quality Boards and promote programs that monitor all water quality objectives necessary for the protection of fishery uses through various efforts (i.e., waste discharge requirements and general NPDES, TMDLs, etc).
- Utilize existing models, tools and techniques (i.e., Regional Climate System Model, Sea level Rise and Coastal Flooding Impacts Viewer) to improve the accuracy of ecological forecasting to anticipate and offset the threat of climate change related to global human population growth and development on salmonids biological (population viability) and physical environment (habitat).

Restoration and Threat Reduction

- Promote installation of in-stream large woody debris and projects to improve off-channel/floodplain habitats to benefit freshwater survival in areas with extant populations.
- Promote practices to improve habitat conditions including but not limited to, preservation of existing tidal and subtidal habitats and restoration of habitats that have been degraded by past development and associated land uses. Several relevant efforts have been made to identify and prioritize these efforts, which include e estuary actions for the San Francisco Bay and the importance of tidal freshwater habitat.
- Implement recovery actions identified in draft recovery plans to address poor habitat conditions and abate threats in independent populations.
- Develop water conservation measures at local and State levels to include a drought management plan for each watershed that is triggered by minimum flow requirements.
- Work with the agricultural community to develop water conservation strategies protective of listed steelhead and salmon.
- Collaborate and support the SWRCB to reduce surface water diversions and increase oversight and responsibility for regulating groundwater hydrologically connected to surface flows.
- Participate in land and water use planning with local, county, and State agencies that have direct control and responsibilities over non-Federal practices.

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NATIONAL MARINE FISHERIES SERVICE
5-YEAR REVIEW:
CCC steelhead DPS and NC steelhead DPS

Current Classification:

CCC steelhead DPS - threatened
NC steelhead DPS - threatened

Recommendation resulting from the 5-Year Review:

CCC steelhead DPS: Retain current ESA classification as threatened.

NC steelhead DPS: Retain current ESA classification as threatened. Remove two currently listed hatchery stocks from the DPS because they have been terminated and no longer exist.

REGIONAL OFFICE APPROVAL:

Lead Regional Administrator, NMFS

Approve: Cla S Yates for Rodney McInnis Date: 11 Nov 2011

Cooperating Regional Administrator, NMFS

_____Concur _____ Do Not Concur

Signature_____ Date_____

HEADQUARTERS APPROVAL:

Assistant Administrator, NMFS

✓ Concur _____ Do Not Concur

Signature_____ Date 11/29/11